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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART. ORIGINAL ARTICLES

Horse-breeding in the Argentine Republic at the Present Day

by

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of the National University of Buenos-Aires.*

The results of the last census of livestock in the Argentine Republic are not yet known, while awaiting their publication, however, we may quote the following figures from the 1908 census: — 7 531 376 horses — 285 086 donkeys — 465 037 mules. Further, the recent census of livestock being complete, at least for the province of Buenos Aires, a comparison may be drawn for this important region between the 1908 and 1916 figures relating to the same animals.

	1908	1916	Increase
Horses	2 519 953	3 344 554	824 601
Donkeys	4 341	7 284	2 900
Mules	14 469	19 347	4 872

The number of equines has thus increased considerably: more than $\frac{1}{3}$ in a period of 8 years; if the proportion for the remaining regions of the Argentine is the same, the country as a whole should possess more than 9 million of these animals.

HISTORICAL. — In the Argentine, as is well known, the horse owes its origin to a few animals abandoned by don PEDRO DE MENDOZA two years after the foundation of Buenos-Aires (1537) and to those imported, a few years after, from Peru, Paraguay and Chili. The possibility of a type existing before Columbus, and descended directly from *Equus rectidens*, though often discussed and recognised to be plausible, has not yet been sufficiently proved.

The horses imported originally by the Spaniards were of the Andalusian type; as a result of unchecked multiplication in the boundless pampa they gave rise to those innumerable semi-wild herds known as *cimarrones* or *baguales* (1) which made such an impression upon the first writers who dealt with la Plata. So arose the *criolla* or creole race of primitive and hardy animals of which, for long years, man did not take the slightest care, allowing them to breed in conditions entirely natural and not always favourable. The result was that, as a result of its inadequate size and girth, the frequently excessive reduction of chest and lack of symmetry, the creole horse was obviously incapable of constituting the ideal type, necessary to the country when the general conditions of agriculture and stock-raising began to improve. There undoubtedly occurred, in various places, better built animals, of bigger size and more blood, which if properly selected, might have given good results, but the Argentine breeders usually preferred to have recourse to crossing with breeding animals imported from Europe in their scheme for improving their live stock.

What are the results of this line of conduct and how does horse-breeding stand at the present day? These points we are now about to consider.

IMPORTATIONS. — The importation of horses began to reach a certain importance in the latter half of the 19th. century. Between 1886 to 1914, as many as 13 174 breeding animals were imported and, during the period 1900-1914, the number was 7 130, divided as follows:

English Thoroughbred	2712	Shetland	64
Percheron	1080	Oriental	43
Clydesdale	729	Pony	44
Hackney	529	Dutch	23
Shire	446	Hunter	12
Anglo-Norman	201	Andalusian	17
Yorkshire Coach	114	Morgan	3
Suffolk	69	Various	715
		Cross-bred	238

Broadly speaking, all the principal races and categories of horses have been introduced into the Argentine, but the following distinctly predominate: English Thoroughbred — Hackney — Percheron — Clydesdale — Shire.

These animals have been used to a limited extent for the breeding of pedigree animals, but much more widely for crossing with the local breeds, which has given rise to a fairly considerable number of cross-breeds. Table I gives the numbers of stud animals now inscribed in the Stud Book of the "Sociedad Rural Argentina".

(1) The names given to animals which have reverted to the wild state.

(Ed.).

TABLE I. — *Distribution of the 19 389 horses entered in the Stud Book of the "Sociedad Rural Argentina".*

	Buenos-Aires	Cordoba	Santa Fe	Entre Rios	Pampa
Percherons	5 171	353	187	—	25
Clydesdales	3 887	414	55	—	216
Shires	3 135	64	248	—	48
Suffolks	419	—	—	—	1
Boulonnais	249	—	35	—	—
Belgian	71	—	—	—	—
Hackneys	2 496	345	180	9	3
Yorkshires	567	—	—	—	—
Anglo-Normans	539	71	90	—	—
Orloff	167	—	—	—	—
Hunters	165	—	—	—	—
Polo Ponies	57	19	42	—	—
American Trotters	28	—	—	—	—
Holstein	10	—	—	—	—
Shetland Ponies	9	16	—	—	—
Trakehner	1	—	—	—	—
Oldenburg	—	—	—	—	16
<i>Totals</i>	<i>16 962</i>	<i>1 282</i>	<i>837</i>	<i>9</i>	<i>309</i>

PRODUCTION. — The production of pedigree horses is in relation with the number of breeders of this class of animal, i. e. 278, distributed as follows :

Number of Breeders	Breed	Number of Breeders	Breed
50	Percheron	4	Shetland
61	Clydesdale	1	Belgian
36	Shire	3	American Trotter
28	Hackney	5	Hunter
18	Anglo-Norman	2	Oldenburg
10	Boulonnais	1	Trakehner
9	Polo Pony	1	Orloff
8	Suffolk Punch		

The number of English pedigree stallions and mares now existing in the Argentine is calculated at over 4 300. They are distributed among 200 stables.

In 1908, among crossbreds there were the following :

241 911	Percheron	45 510	Hackneys
220 074	Clydesdales	19 184	Yorkshires
67 700	Anglo-Normans	19 184	Shires

At the present day the numbers are undoubtedly higher.

In order to form a judgment of horse-breeding generally, it will be necessary to examine in turn the different 3 categories i. e. saddle-horses, light draught animals, and cart-horses.

The great majority of horses in the Argentine belong to the first type, as is shown by the census for the Province of Buenos-Aires: Saddle-horses, 573 182 — Light-draught horses, 543 258 — Cart-horses, 167 648.

Many of the saddle and light-draught horses are included under the name of creole horses, which means to say that they are crossbreds of poor blood, seeing that, properly speaking, pure-bred creole horses no longer exist. The number of breeders who boast of possessing *uncontaminated* animals can be counted on the fingers of one's hand, and even in these cases it might sometimes be shown that they have employed (though perhaps only incidentally) imported breeding animals.

In any case, it is certain that the numerous groups of light-draft animals to day still vary in size, weight and conformation. This is the result of a lack of a definite aim in breeding, itself partly due to the deplorable absence of a big export or even a home market. This lack of orientation, as well as the question of prices which, before the war, were far from remunerative, has discouraged many breeders and led them to devote their attention to other aspects of the live-stock industry.

EXPORT. — From 1886 to 1914, the number of horses exported was 358 270 and, during the period 1905-1914, the annual export figures to the neighbouring South American Republics and South Africa, were as follows:

1905	20 435 horses	1910	4 447 horses
1906	8 574	1911	5 934
1907	7 374	1912	12 549
1908	5 082	1913	13 549
1909	4 765	1914	15 882

BREEDING METHODS. — In the Argentine it has too often happened that breeders, either out of their own conviction or for some particular interest, have followed completely opposite methods, some being immense enthusiasts for English thoroughbreds, others for the Hackney, the Anglo-Norman, the Yorkshire Coach, etc. The result is a continual changing of ideas which has inevitably led to the present state of affairs.

The Argentine possesses a considerable number of excellent English thoroughbreds for stud purposes; the following stallions may be quoted which have either been or are still being used: Flying Tox — Diamond Jubilee — Jardy — Ormonde — Pietermaritzburg — Cyllene — Polar Star. Nor is there a lack of types for crossing, such as Val d'Or. Unfortunately, this magnificent material is devoted entirely to the interests of the turf, very popular in the country. It would, however, have allowed of the formation of a magnificent collection of half-breds adapted to various needs, whereas what actually exists is incomparably less important than what might and undoubtedly will be obtained eventually. In view of these antecedents, there is no room for astonishment if, notwithstanding the large number of horses existing in the country, it is difficult to obtain homogeneous lots of any importance. The admission is not a very satisfactory one to make and yet, in spite of everything, we have faith in

the future of the Argentine in this respect and that for the following reasons:

In order to arouse the energy and latent capacity of breeders a recognised international market is required, one sure of paying good prices and capable of affording a clear index of requirements. After the present world conflagration this market is bound to be established, and there will then ensue a rapid transformation of this branch of animal production. In subsequent articles, treating of the production of cattle and sheep in the Argentine, we shall be able to prove that the existence of a definite and lucrative market has been the direct cause of improvements occurring in the breeding of both these classes of animals. Even with regard to horse-breeding, however, we can cite an example which affords abundant support of the opinion expressed above.

Hitherto the breeding of cart-horses has not been influenced by any idea of an external market but has been obliged to respond to the ever increasing demands of agriculture, industry and trade.

Requirements in the shape of ordinary saddle and light draught animals, army horses, etc., have always been relatively easy to satisfy owing to the large number of horses available relatively to the limited requirements along these lines. On the other hand, with regard to cart-horses, it was a question of building up a type which absolutely did not exist and which must fulfil actual, positive requirements.

A start was thus made, first with Shires and Clydesdales, then with Percherons, and soon the number of pure bred and half bred animals was considerable. At the present time the majority of cart-horses, in the large towns of the Argentine are sound Shire and Clydesdale crosses, heavy animals showing the characteristics of these English breeds.

The turn of the Percherons has come relatively recently and already their success has surpassed that of the Clydesdales. The Percheron, in fact, is the real farm-horse which was wanted. It is the post-horse type which gives the best results: ample in stature and girth, hardy, strong, hardworking, it is adapted equally well both to the slow work of ploughing and to more rapid carting work, etc. If necessary, it goes well between the shafts of a country conveyance. It has been remarked, besides, that the offspring of crosses between these Percherons and good native mares of sufficient stature and muscle often gave excellent all-round animals, in great favour in the country and also for artillery.

At the exhibitions of the "Sociedad Rural Argentina" and also at provincial shows, one can often admire a really striking collection of these heavy animals. On the other hand, Boulonnais and Belgian horses have not yet found a favourable environment, and the same may be said of the Suffolk Punch.

FEEDING. — Horse-breeding in the Argentine is characterised by the system of free pasturage. With the exception of valuable pedigree animals, reared in *cabanas* and of horses employed in the large urban centres, all horses live continuously in the open, exposed to the inclemencies of the weather and the vagaries of the seasons. The horses of the first cate-

TABLE II. — *Prices (in paper pesos) of stud animals sold at the exhibition of the "Sociedad Rural Argentina" in 1916.*

Breeds	Animals presented	Animals sold	Prices		
			Minimum	Maximum	Average
Arabs	8 } Stallions	7	2	1 200 pesos	1 500 pesos
		1	—	—	1 350 pesos
English Thoroughbred	10 } Stallions	9	1	500	500
		1	1	600	600
Hunter	5 } Stallions	5	3	850	900
Polo Pony	5 } Stallions	4	2	400	1 100
		1	1	400	400
Criolla	6 } Stallions	6	1	600	600
Hackney	35 } Stallions	28	14	400	1 400
		7	1	400	400
Hackney Pony.	6 } Stallions	4	2	450	800
		2	—	—	—
Yorkshire	8 } Stallions	6	5	600	1 400
		2	1	—	890
Anglo-Norman	2 } Stallions	1	1	1 050	1 050
		1	—	—	—
American trotter.	1	1	—	—	—
Percheron	62 } Stallions	51	43	350	7 000
		11	1	300	300
Boujonnais	18 } Stallions	13	4	1 600	2 000
		5	—	—	1 750
Breton	3 } Stallions	3	—	—	—
Suffolk	8 } Stallions	5	2	1 100	1 300
		3	—	—	—
Clydesdale.	35 } Stallions	32	23	450	2 000
		3	—	—	998
Shire	22 } Stallions	17	13	900	6 500
		5	1	450	450

gory are given various rations, almost always including: hay — maize or oats — bran, etc., but the overwhelming majority live exclusively on natural pastures or lucerne. Notwithstanding this free kind of life and feeding, the animals usually remain in good condition and work well, especially where the *pastos* (pastures) are rich and of the *tiernos* (tender) type or in the *alfalfares* (lucerne fields) zone. Speaking from our own experience, we

may say that good Percheron crosses, employed throughout the year on ploughing work, seeding, harvesting and carting grain, etc., and fed exclusively on the lucerne from *polveros* (enclosures) in which they are shut after work, keep in excellent condition and work hard and well.

CARE. — In the *pampa* horses go unshod, as stones or any other similar obstacles are completely absent, and the hoof wears down very slowly and does not split. The grooming leaves a fair amount to be desired, frequently the only attention given is to put the stallion with a certain number of mares at rutting time. An almost universal character among Argentine horses is their extreme docility once they have been broken and trained to work.

ENCOURAGEMENT. — Apart from the prizes offered at race-meetings and country exhibitions, and a certain number of purchases made by theockey Club for army purposes, there are no other forms of encouragement worth mentioning.

VALUE OF HORSES. — As stated above, in normal times prices have never been very good, and consequently many breeders, especially those interested in light-draught and saddle horses, have preferred to relinquish horses and devote themselves to fattening cattle.

Table II shows, in paper pesos (1) the price of the breeding animals sold at the exhibition of the "Sociedad Rural Argentina" in 1916.

As regards the value of the common type of horses exported of recent years, this may be estimated as varying around 200 pesos per head.

(1) 1 paper peso of the Argentine Republic = 15. *ml.*

(Ed.)

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

517 - **Agriculture and Stock Breeding in Uruguay.** - Report received from Dr. ENRIQUE JOSÉ ROVERA, Uruguayan Delegate to the International Institute of Agriculture (extract from a Report by the engineer SOCRATES S. RODRIGUEZ).

CLIMATE. - The average annual temperature is 16.5° C, and the minimum temperature is rarely as low as -1° or -2° . *Snow* is unknown throughout the country, so that cultivation and grazing can continue during the whole year. The average temperatures for the different seasons and months are: - *summer* 23.94° C (December 21.09° , January 22.82° , February 22.01°); *autumn* 16.38° C (March 20.52° , April 16.12° , May 12.48°); *winter* 10.18° C (June 9.78° , July 9.9° , August 10.87°); *spring* 15.17° C (September 12.28° , October 14.69° , November 18.53°).

The *rains* are a little more frequent in autumn and distributed fairly evenly amongst the other three seasons. The annual fall is normally 895 mm., distributed as follows: *summer* 211.5 mm. (December 77.2 mm.; January 87.6 mm.; February 46.7 mm.); *autumn* 254.2 mm. (March 102.5 mm.; April 85.1 mm.; May 66.6 mm.); *winter* 229.8 mm. (June 66.8 mm.; July 82.5 mm.; August 80.5 mm.); *spring* 200.7 mm. (September 63.4 mm.; October 73.9 mm.; November 63.4 mm.). The number of rainy days is, on the average, 60 a year. The amount of rain which falls at a time is fairly regular, and exceeds 20 mm. in 12 cases only.

The average annual number of *cloudy days* is 52 %, and the average for the four seasons is: - 47 % in summer, 51 % in autumn, 59 % in winter and 52 % in spring.

There are 32 *windy days* annually, when the velocity of the wind varies from 25 to 37 miles an hour, and 6 days on which the velocity exceeds 37 miles an hour. There are very strong winds in every season, especially

in spring. The average annual wind velocity is 6.679 miles an hour, differing little in the various months. The average seasonal velocity is: 6.757 miles an hour in summer; 6.083 miles an hour in autumn; 6.860 miles an hour in winter; 6.932 miles an hour in spring.

The most characteristic feature of the climate of Uruguay is the sudden changes in temperature, which are particularly marked in spring and summer. Variations of from 8° to 10° in one hour are not infrequent. These rapid variations are caused by the transition from the moderate warm and moist north or north-westerly winds to the more violent and drier strong south or south-easterly winds.

Hail falls, on an average, 5 times a year, 3 times in winter and twice in spring. It is rare in autumn (harvest season) and unknown in summer.

Soil. — Geologically, the soil of Uruguay consists of primitive rock — granite, porphyry, etc. The agricultural soils are usually strong, of silicious loam, slightly humiferous, rich in organic substances and potash, poor in lime and phosphoric acid. They are usually extremely fertile soils. The following analysis gives some idea of their composition.

Analysis of a Sample of Soil from Uruguay.

		Soil	Sub-soil
Physical analysis	Coarse sand	78.4.8 ⁹ / ₁₀₀	805.8 ⁹ / ₁₀₀
	Fine sand	114.2	117.7
	Clay	97.6	66.4
	Organic matter	17.6	10.1
Chemical analysis	Nitrogen	1.14 ⁹ / ₁₀₀	0.711 ⁹ / ₁₀₀
	Total phosphoric acid	0.462	0.151
	Assimilable phosphoric acid	0.0258	0.0283
	Lime	3.516	11.325
	Total potash	10.050	11.719
	Assimilable potash	0.491	0.389
	Magnesia	1.780	0.790

IRRIGATION. — The land is irrigated by a great hydrographic system whose principal arteries are 16 rivers, into which flow numerous tributaries, which, in their turn, are fed by many secondary streams. By its complexity, this network forms an admirable irrigation system naturally composed of 500 water-courses and amply sufficient for the agricultural requirements of the country. Many farms are also supplied with pumping machines worked by wind by which their cisterns and reservoirs may be filled. This precaution is necessary because, during a period of drought, it sometimes, though rarely, happens that the water-courses fall considerably, or are even completely dried up.

WILD VEGETATION. — This is distinguished by the lack of large trees on the low mountains, on the slopes of the hills and in the valleys.

"Espina de la cruz" (*Colletia cruciata*), "coronilla" (*Scutia buxifolia*), "molle" (*Dalea depreniensis*), grow amongst the rocks together with: myrtles, "canelón" (*Myrsine* sp.), "sombra de toro" (*Lodina rhombifolia*), "tala" (*Celtis Tala*) and "romerillo" (*Heterothymus brunscoides*), which are mostly only shrubs.

A styrax (*Styrax leprosum*), many euphorbia of the genera *Croton* and *Sebastiania*, and many other bushy species with small, coriaceous leaves, give the vegetation of the mountain chains of the Minas, Cerro Largo and Tacuarembó departments a very characteristic appearance.

The most common plant of the sandy shores of the Atlantic, continually swept by winds from the south, is *Colleia cruciata*. The above-mentioned shrubs grow amongst the gneiss and granite of the hill sides. In all other soils there is an abundant growth of herbaceous plants — Leguminosae, Compositae, Labiatae, small Graminaceae. The vegetation changes down by the water-courses, where the trees and bushes are always finer and more vigorous.

The Myrtaceae family is represented by more than 40 species belonging to different genera, which are usually found near running water. The most important of these, and those which require most water are: — "sarandí blanco" (*Phyllanthus Sellowianus* = *P. niriphoideus*); "sarandí colorado" (*Cephalanthus Sarandí*); "mata ajo" (*Lucuma Sellowii*); "selbo" (*Erythrina Crista-galli*), which forms forests along some of the rivers.

The other most common plants, in order of importance, are: "laurel blanco" (*Oreodaphne acutifolia*), "cotonilla" (*Scutia buxifolia*); "sombra di toro" (*Lodina rhombifolia*), "blanquillos" (*Sebastiania angustifolia* and *S. serrata*), "árbol de la leche" (*Sapium aucuparium* = *Euclea bistrandulosa*), "palo amarillo" (*Berberis glaucescens*), "timbo", "rama negra" (*Cassia corymbosa*), an acacia called "aroma" or "espinillo" (*Acacia adenocarpa* A. Farnesiana), "sauce del país" (*Salix Humboldtiana*), "canelón" (*Myrsine* sp.), "higuera" (*Urostigma* sp.); these two latter reach gigantic dimensions.

The natural forests, composed of native varieties only, are thick and vigorous, and grow along the banks of the large and small streams. In spite of its many varieties of trees, Uruguay has no real forests suitable for working. The area occupied by natural forests is 1 071 172 acres, and by forests which are cultivated and worked, 83 371 acres.

ECONOMIC AND LEGAL CONDITIONS OF LANDED PROPERTY. — The Government has sold some estates, but, as a rule, it does not sell transferable property to private individuals at the present time. This regulation will hold till the national cadaster is brought to an end.

The mortgage Bank of Uruguay ("Banco hipotecario del Uruguay") gives great facilities for the purchase of land to be used for agricultural and breeding purposes. It lends (up to $\frac{1}{3}$ of the appraised value of the landed property) on mortgages quoted at the commercial Exchange of Montevideo. The loans are amortizable in 30 years by monthly payments of 6.85 pesos (1) for each 1 000 pesos advanced (interest, amortization and commission); payment may also be made quarterly or half-yearly. The mortgages may be discharged at any time.

For the purpose of determining their sale price or rent, the natural pasture-lands (campos) are classed as either "very good", "normal" or "ordinary". Their sale value varies from 12 to 36 pesos per acre, according to their nature and situation. Meadows quoted at from 12 to 18 pesos, are of the ordinary type, not very uniform, excellent for breeding cattle and sheep, but little suited for fattening-up, and situated at a distance of 112 — 931 miles from the department of Montevideo. The following are the sale prices in the different departments in pesos per acre:

(1) 1 gold peso = 45. 3 d. at par.

Artigas	12 - 14 pesos	Flores	32 - 44 pesos
Bacurembo	12 - 14	Colonia	32 - 44
Rivera	12 - 14	Koelsa	14 - 18
Cerro Largo	16 - 20	Maldonado	10 - 16
Creinta y Tres	16 - 20	Salto	14 - 18
San José	24 - 40	Paysandú	14 - 20
Florida	32 - 40	Rio Negro	10 - 24
Grain	32 - 40		

The rent of the Government natural pasture land is between 0.50 and 0.80 pesos per acre; that of private pasture, between 0.90 and 2.80 pesos per acre.

The rent corresponds to the price of the grass, which is based on the top, as shown in Table I.

TABLE I. — *Ratio between: grass crop, price of grass and rent of meadows per acre, in Uruguay.*

Grass crop tons per acre	Rent pesos per acre	Price of grass pesos per metric ton
0 - 1	0.87	0.72
1 - 2	1.02	0.58
2 - 2 $\frac{3}{4}$	1.18	0.42
2 $\frac{3}{4}$ - 3 $\frac{1}{2}$	1.34	0.37
3 $\frac{1}{2}$ - 4 $\frac{1}{4}$	1.49	0.33
4 $\frac{1}{4}$ - 5	1.65	0.31
5 - 6	1.80	0.29
6 - 6 $\frac{3}{4}$	1.96	0.28
6 $\frac{3}{4}$ - 7 $\frac{1}{8}$	2.11	0.27
7 $\frac{1}{8}$ - 8 $\frac{1}{4}$	2.27	0.26
8 $\frac{1}{4}$ - 9	2.42	0.25
9 - 10	2.58	0.25

The majority of leases are for periods of from 4 to 10 years.

In rural districts the land tax is 4 per thousand of the value of the land, excluding improvements, on property on which the annual income does not exceed 2 500 pesos, in those cases in which the owner possesses no other estate. In all other cases it is 4.5 per thousand. In urban and suburban districts the tax is 6.5 per thousand on the total value of the ground and the improvements.

According to the 1911 census, Uruguay had, at that time, a population of 1 177 560 inhabitants (of which $\frac{1}{4}$ were of foreign nationality), that is to say 1.7 per square mile. This is a larger population than that of most of the South American States. The census showed that there were 15 534 owners of agricultural estates, 11 924 farmers and 3 950 small farmers. There were 56 560 rural estates, of which 14 873 were stock farms, 25 944 purely agricultural and 15 473 mixed.

Average cost of labour.

- 1) "Capataces", or foremen on stock farms: 20 to 40 pesos a month, board and lodging.
- 2) "Peones" (day labourers) not permanent: 0.75 to 1.50 pesos a day; 2 pesos a day if they have their own horse.
- 3) Mechanics: from 1.50 to 2 pesos a day.
- 4) Mechanics for mechanical cultivation: 50 to 60 pesos a month, and board.
- 5) During sheep-shearing, when much labour is required, 0.03 to 0.05 peso per sh. sheared is paid, according to whether shearing is done by machine or hand.

CROPS. — About 2 500 000 acres are under cultivation, and about 1 650 000 acres of this area are under wheat and maize. The country produces sufficient cereals and oil seeds for its own consumption, and exports wheat, maize (grain and flour), flax, lucerne, etc., to the annual value of from 4 to 5 million gold pesos.

Agriculture is carried out on an extensive scale, with little preparatory work, no manure and no irrigation. It was only in 1915, thanks to the initiative of the State and of the Central Railway Company, that selected wheat seed was first distributed to the farmers, great facilities of payment being offered. This has raised the production by from 6 cwt. per acre (general average for the whole country) to 9 to 10 cwt. per acre. In considering these figures it must not be forgotten that, in Uruguay, sowing is very thin, about 53 lbs. of seed being used per acre.

Table II gives data for the year 1913-1914.

TABLE II. — *Principal crops of Uruguay in the Year 1913-1914.*

	Area sown	Quantity of seed used		Crop	Value of the crop per acre
	acres	tons	tons	tons	pesos
Wheat	901 453	23 420	157 696	—	9.85
Maize	692 484	3 882	178 563	—	8.24
Flax	128 232	2 572	24 065	—	8.91
Oats	97 443	2 490	26 428	—	—
Barley	14 048	325	3 528	—	—
<i>Phalaris canariensis</i>	5 957	952	1 263	—	—
Rye	452	13	116	—	—

The cultivation of forage crops has made rapid progress. The 1906 census showed them to be grown over 312 166 acres; in 1916 this area had doubled. The forage crops most cultivated are oats and lucerne. Oats are the most common, and are also used as pasture. They are sown in the first months of the year and grazed between mid-April and mid-September, if a grain crop is desired as well, or, when this is not the case, up to mid-October. During the 5 months, grazing oats produce about 127 cwt. of fodder per acre. A field of oats lasts from 2 to 2½ years.

The yield of lucerne is from 2 to 6 tons per acre. It is cut from to 5 times a year, and the field lasts between 5 and 20 years.

On the basis of quality, *natural* meadows and pasture grounds ("campos") are divided into "very good" or "choice", "good", "regular". In the meadows of the first group an animal of from 8 to 12 cwt. may easily be fattened on 1 1/2 or 2 1/2 acres, in those of the 2nd. group on 2 1/2 to 3 acres, and, in the 3rd, on 3 to 4 acres. In the 3rd group fattening is either very easy nor very economical.

The food value of the natural meadows and pasture land is such that an animal of 8 cwt. may be kept on a daily ration of from 44 to 50 lbs. and fattened on a ration of 99 to 110 lbs. The tender grass (*pastos tiernos*) of Uruguay contains on an average: 1.7 % of albuminoid, 0.6 % fat, with the starch value 11.1. This starch value equals that of lucerne and of oats (hay).

Taking into consideration their high food value, good yield and the high water content of their products, the meadows of Uruguay are extremely well suited to the production of hay, indeed the yield is very high, 50 to 70 % the weight of the grass. The spring cut gives 12 to 32 cwt. per acre, the autumn cut a little less. Table III gives data concerning the best fodder plants of Uruguay.

TABLE III. — *Yield and composition of the principal fodder crops of Uruguay.*

Common name	Yield per acre		Composition (per cent)			
	Grass (cwt.)	Hay (cwt.)	Albu- minoid	Fat	Fibre	Nitro- gen-free extract
<i>Dactylis glomerata</i> timothy	163	47	8.50	2.52	21.77	29.51
<i>Dactylis glomerata</i> timothy	99	39	1.82	0.50	12.10	13.20
<i>Dactylis glomerata</i> dactiloglomerado	160	47	3.19	0.97	8.17	11.47
<i>Festuca pratensis</i> festuca	150	44	3.92	0.91	16.24	7.44
<i>Festuca vulgaris</i> pasto ilusión	134	39	—	—	—	—
<i>Trifolium pratense</i> trébol morado	80	20	3.02	0.71	4.00	8.83
<i>Trifolium</i> " blanco	75	19	2.63	1.20	1.92	4.74
<i>Trifolium</i> " híbrido	94	29	3.37	0.75	4.43	10.55
<i>Lolium stolonum</i> ray grass	168	63	7.31	2.00	18.95	17.15
<i>Lolium stolonum</i> ray grass	213	80	7.02	2.02	26.33	27.10
<i>Pisum sativum</i> pea	100	32	2.69	0.46	14.10	9.00
<i>Eleusine indica</i> flor morada	175	—	—	—	—	—
<i>Eleusine indica</i> cebadilla	246	—	—	—	—	—

Sugar beet, grown for a sugar-factory, is cultivated on 8 648 acres.

In 1914, Tobacco was cultivated over an area of 2 503 acres and yielded 272 cwt. of dry leaves.

According to the 1908 census, fruit growing occupies more than 74 133 acres, and the production exceeds 196 cwt. of fruit. Plums are grown to

a very large extent (over 2 million trees in bearing). They do well in all districts, and the trees bear when 3 years old. Oranges do well in the southern part of the country, the best are those of Salto, Cerro Largo, etc. The olive tree has only been introduced of late years. Pears, apples, apricots, cherries and the majority of the fruit trees of the temperate zone do well and bear abundantly throughout Uruguay.

Vine-growing has greatly developed. In 1912 there were 2 067 vine yards covering an area of 14 826 acres, with more than 20 million plants bearing fruit. In 1911, 3483 tons of grapes yielding 2 482 600 gallons of wine were gathered.

ANIMAL PRODUCTION. — Laws have been passed to protect cattle from the importation of contagious diseases, and to prevent the spread of infection within the country. The chief diseases calling for sanitary control (isolation of stables, obligatory vaccination, etc.) are: — symptomatic anthrax and tuberculosis of all animals; "tristeza" or cattle piroplasmosis, sheep scab, aphtous fever of cattle, sheep and pigs.

In a normal year the average mortality from all causes is 4 % for cattle, 2 to 3 % for sheep, taking 4 years as the average length of life.

The cattle graze over a large area and the best natural pastures are used. These are composed essentially of Gramineae, Leguminosae and Chenopodiaceae, and divided into "pastos duros" (rough grass), suitable for nourishment only, and "pastos tiernos" (tender grass), suitable for fattening.

On many farms where sheep and cattle are bred, lucerne and oat fields are used throughout the year for feeding cattle kept in stables either permanently or only during part of the year. Other farms use the oat fields for the winter feeding of young cattle. In this case they are kept in the fields from April to the end of October. By this method it is easily possible to fatten 1 animal per acre, and 2.5 to 3 sets of animals are thus fattened per annum.

Breeding animals kept in the stables throughout the year are fed oats, lucerne (fresh and as hay), maize, linseed cake, etc. As a rule, a calf between 6 and 8 months receives, besides fresh lucerne and lucerne hay each evening, a complementary ration of from 6 $\frac{1}{2}$ to 8 $\frac{3}{4}$ lbs., which increases as the calf grows older, till, at 2 years, it receives 17 $\frac{1}{2}$ to 22 lbs. fed in 3 different lots. The following mixture is frequently used: 8 parts by weight of oats + 5 parts of maize + 2 of bran + 2 of linseed.

The following breeds are reared in Uruguay:

I. — **HORSES:** English pure-breeds, Morgan, Criolla, Boulonnais, Clydesdale, Trakehner Hackney. Their total number is 600 000.

II. — **CATTLE:** 1) — *Beef-Cattle:* Herefords, which represent $\frac{3}{8}$ of all the cattle, Short horns, Polled-Angus. The "criollo" breed, descended from the Spanish race, has been improved by crossing with these 3 races, and the majority of the cattle are descendants of these crossings with fixed characteristics. The 1908 census showed a total of 8 200 000 cattle, of which $\frac{4}{8}$ were beef cattle.

2) *Dairy Cattle:* As yet there is no dairy breed well adapted to the surroundings and showing decided advantages over the other breeds. The following pure breeds have been kept

for breeding purposes; Dutch, Norman, Flemish, Schwitz, Jersey. Many farms specialise in the breeding of improved cattle with a view to the production of milk, which is their chief industry (1). According to the 1908 census the total number of dairy cattle of that date was 165 854, divided as follows:—10 775 pure breeds, 269 103 progeny of various crosses, 205 385 'criollas', 60 591 non-specified. The census now being taken shows these numbers to have increased greatly.

III: **SHEEP**: Their total number is 27 million. The breeds which are most frequently found and which have proved to be the best are:—Merino, Rambouillet, Lincoln, Romney Marsh. The Hampshire and Shropshire breeds have been introduced recently.

IV.: **PIGS**: Berkshire, Large Black, Poland China, Middle White Yorkshire. Their total number is 200 000.

Cattle attain their full strength at 4 $\frac{1}{2}$ — 5 years, in the case of improved stock, and at 7 — 7 $\frac{1}{2}$ years in the case of "criollas". Table IV shows the average weight of animals from 3 to 5 years old.

TABLE IV. — Average weight of cattle from 3 to 5 years of age.

	at 2 years	at 4 years	at 5 years
	lbs.	lbs.	lbs.
Hertford oxen	880	1144-1210	1232-1259
Shorthorn oxen	1012-1056	1166-1232	1232-1276
Cows	814	880	924-964
Bulls	1034-1100	1100-1166	1166-1320

The average annual number of births among cows kept on good natural pasture land is 80 %, on pasture of inferior quality, from 65 to 70 %.

The average prices of good breeding cattle are:—oxen, 35 to 40 pesos, bulls 30 to 35 pesos, cows 28 to 32 pesos, calves 8 to 10 pesos.

The average prices of animals put to grass for fattening are:—oxen 53.91 pesos, bulls 51.20 pesos, cows 38.68 pesos, calves 16.77 pesos. These prices decrease during the months when grazing is at its maximum and increase during those when it is at its minimum. Grazing is most general in March, and diminishes continuously till July and August, when it increases again till December.

518 — **The Purification of Rain Water for Human Consumption.** — See No. 582 of this Bulletin.

519 — **Courses of Practical Agricultural Engineering in Italy and France.** — I. TOSCANO, DARIO, Course of practical agricultural engineering in Sicily, in *Il Coltivatore*, Year 63, No. 12, pp. 394-395. Casale Monferrato, April 30, 1917. — II. School for drivers of agricultural machines, in *Le Progrès Agricole et Viticole*, Year 34, Vol. 67, No. 8, p. 180. Montpellier, February 25, 1917.

I. **Courses of practical agricultural engineering in Sicily.** — Thanks to the initiative of an inter-provincial meeting of the Agricultural Com-

(1) See also, in B, 1916, pp. 677-685, the Report by Dr ARTURO ABELLO: *Dairying in Uruguay*.

missions held at Catania in February, 1917, under the patronage of the Department of Agriculture, courses for instruction in agricultural engineering were instituted, and are about to be inaugurated. They are supported by funds supplied by the provincial Government departments and by the Chambers of Commerce of the Sicilian provinces, as well as by a subsidy from the Department of Agriculture.

There will be two courses in the provinces of Catania and Caltanissetta, one at the Royal Oenological School of Catania, the other at the Agricultural School of Caltagirone. Another course will be held at Palermo, Girgenti and Trapani, a 4th. at Syracuse at the Royal Station for Agricultural Machinery annexed to the "Cantina sperimentale" (Oenological Experiment Station) of Noto, and a 5th. at Messina.

Each course will last about a month, and the pupils will be chosen from amongst farmers and mechanics. The instruction will be, above all, practical and will include 6 to 8 hours a day of practical work on the use and general management of agricultural machines and motors, methods of taking them down and assembling them, repairs. There are only 2 hours of oral instruction on agricultural machines, motors and material used in the construction of machines, fuels and lubricants, etc. At the end of the course a certificate will be given to those who have shown the required standard of efficiency.

So many applications have been received that it will probably be necessary to repeat the course.

II. — *School for drivers of agricultural machines in France.* — A special residential school for drivers of agricultural machines, called the "G. Michel Pujos Institute", has just been founded at Noisy-le-Grand (Seine-et-Oise). The aim of the Institute is to train specialists in the use and repair of agricultural machines, particularly motors. It will also be used for experimental and demonstration purposes and will answer enquiries concerning mechanical cultivation, etc.

320 — *School for Farmers at the Royal Colonial Garden of Palermo.* — BOKAI, A. in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Pt. 2, pp. 3-7, Palermo, 1916.

The aim of this new school for farmers started at the Royal Colonial Garden of Palermo, is to train the Sicilian peasant in agricultural methods so that he may be capable of acting on his own initiative. Instruction is almost entirely practical, and the syllabus restricted, so that it may be well developed and thoroughly assimilated.

The lectures are public and attended by those farmers who are interested in the subjects treated. The Department of Agriculture makes grants to peasants living at a distance to enable them to attend the school.

There are 6 hours a week of theoretical instruction, of which 3 are devoted to colonial agriculture, 2 to various subjects and 1 to the general knowledge of natural bodies and phenomena. The rest of the time is spent in the garden, where the theories taught in the lectures are applied practically under the supervision of the head and technical staff of the Garden.

The general lines of instruction are given below: —

1) VARIOUS SUBJECTS.

The enemies of health: elements of human and domestic hygiene, preventive and post-hoc measures.

Outlines of the most important discoveries.

Outlines of geography bearing on the principal European emigration tracks.

Italy and her colonies; their agricultural products.

The State and civil institutions. The citizen and his principal rights and duties. Emigration and its laws.

2) GENERAL KNOWLEDGE OF NATURAL BODIES AND PHENOMENA.

Air, water, the earth, light and heat.

Plants and animals. The nourishment and life of plants, their propagation.

3) COLONIAL AGRICULTURE.

CROPS AND CULTIVATION.

21. A Study of Climatic Conditions in Maryland (United States) as Related to the Growth of the Soy-Bean. — McLEAN, FORMAN, T., in *Physiological Researches*, Vol. 2, No. 4, pp. 129-208, 14 fig. Baltimore, February 1917.

A series of experimental researches undertaken for the purpose of determining the quantitative relations between climatic conditions and the growth of plants, the plant (in this case soy bean) being regarded as a kind of integrating and recording instrument, the reading of which is zero at the beginning of each observation period.

In order to have the plants of all tests nearly alike at the beginning of each period, the observations were confined to the first 4 weeks after germination. A new observation period began approximately every 2 weeks, so that the different periods overlapped. The seeds were planted in plunged pots, all containing the same soil, and the pots were furnished with auto-irrigators, to maintain the soil moisture constant. The influence of rainfall was thus removed from the main consideration; temperature, evaporation and sunshine being, therefore, the climatic conditions with which the study chiefly deals.

The 2 stations chosen were Oakland (in the mountains of west Maryland) and Easton (on the eastern shore of Chesapeake Bay). The difference between the 2 types of climate were, as will be seen later, clearly shown by the growth of the plants.

The species employed were *Glycine hispida* Maximov. — *Vicia faba* L. *Lu Mays* L., and *Triticum sativum* L. Only the results obtained with *Glycine hispida* (soy-bean) are dealt with in the paper analysed.

It appears that temperature was clearly the limiting condition for growth, the effect of moisture, though constant and certain, was much less noticeable.

The following is a summary of the most important results of the experiments.

1) During the whole growing period (i. e. throughout the year except when there were frosts) the general conditions were more favourable to the growth of the soy-bean at Easton than at Oakland. This is shown by

all the data concerning — leaf surface — length of stem — dry weight of tops. Thus for the first 2 weeks of growth from seed, the average daily growth increment in terms of leaf-product (the mean of the products obtained by multiplying the length of each leaf by the breadth) was 1.2 for the Easton season and 0.9 for the Oakland season. On the other hand, the growing season was 171 days at Easton and only 103 days at Oakland.

By multiplying each of these two values by the average daily increase in leaf product, the numbers representing the growth possibility of soya at the 2 Stations in question are obtained, namely: $171 \times 1.2 = 205.2$ at Easton: $103 \times 0.9 = 92.7$ at Oakland. The proportion between these two numbers is as 2.21 : 1.00, which shows that the coastal climate is more favourable to plant growth than the mountain climate.

2) The relation between: stem height, leaf surface and dry weight on the one hand, and the climatic factors on the other, varied greatly according to the culture period. The rates of growth in terms of leaf surface and in terms of dry weight varied in a similar manner with the same kind of variations in external conditions, while the growth rates measured in terms of stem elongation varied in another way: thus, it was generally more rapid during the 1st. than during the 2nd. fortnight, while the increase in leaf area and in dry weight was more rapid during the 2nd. fortnight.

3) Temperature is certainly the chief factor, and the temperature curve is similar to the growth curve. The growth conditions of the soybean are very different at the two stations in question. The growing season was terminated by a killing frost earlier at Oakland than at Easton. Nevertheless, the 2 week's period before autumn frost at Oakland exhibited a higher temperature value and higher growth rates than at Easton. In the mild climate of the shores of Chesapeake Bay with its small daily range of temperature, the frostless season is apt to be prolonged until the growth of many plants is much reduced, or entirely checked, by low temperature. In the mountain climate of Maryland, however, with its large daily range of temperature and high nocturnal radiation, the frosts occur earlier in the season, while the day temperatures and the growth rates of many plants are still high. This occasions the almost sudden interruption in curve which is observed at Oakland when autumn sets in.

4) The mean rate of leaf enlargement (as measured by the leaf product) and also the mean rate of increase in dry weight, followed seasonal marches that showed a secondary influence of the moisture conditions of the surroundings, as well as the primary one exerted by temperature. The influence of the general moisture conditions of the surroundings (measured in terms of the ratio of rainfall to evaporation) was most clearly shown when the daily mean temperature was high ($18.8^{\circ} - 24.4^{\circ}$ C.), particularly during the 2nd. fortnight; during the 1st. fortnight, on the contrary, the soybean plants were more susceptible to the influence of the temperature.

522 - **The Reaction Between Dilute Acids and the Phosphorus Compounds of the Soil.** — RUSSELL, E. J., and PRESCOTT, J. A., in *The Journal of Agricultural Science*, Vol. VIII, Part. 1. pp. 65-110 + 9 fig. Cambridge, 1916.

Few reactions are more important to the soil chemist than that involved in the action of dilute acids on the phosphorus compounds of the soil, but owing to its complex nature, little has been definitely ascertained about it.

The writers examine the literature dealing with this subject and state that it is inaccurate to regard the soil as a collection of insoluble inert mineral fragments admixed with small quantities of more soluble substances, some of which arose by weathering or other decomposition processes. They found that the most convenient method of studying the question is to shake a definite weight of the soil (50 or 100 gr.) with a uniform volume (1 litre) of acid at a constant temperature (23° C.) for a definite time, and then to estimate the amount of phosphorus compounds in the solution.

The results enable us to explain what happens when a soil is shaken with a dilute acid in the ordinary process of soil analysis.

The acid dissolves out such phosphorus compounds as it can, and different acids have much the same effect at equivalent concentrations. Nitric, hydrochloric and citric acids give the same results; sulphuric acid gives a somewhat higher result. A reverse action, however, sets in. Some of the phosphoric acid is withdrawn from the solution, in spite of the presence of excess of acid. The process is an ordinary adsorption pro-

cess and obeys the usual law expressed by the equation $y = Kc^{\frac{1}{p}} (1)$; its extent varies with the different acids; it is much more marked in the presence of nitric than of citric acid. The amount of phosphoric acid actually determined by the analyst is, therefore, not the true amount dissolved, but the difference between these two wholly distinct actions. It is now obvious why the amounts of "available phosphoric acid" determined by extraction with dilute acids show such great variations in different methods of analysis, and so little correlation with the actual quantities obtainable by the crop. In no case do they stand for anything actual, but only for a difference between a direct action and an adsorption which varies with the nature of the acid and the conditions of the experiment.

So long as they are confined to the same type of soil, however, any of the acids investigated would have given useful results, but difficulties would arise directly an attempt was made to compare dissimilar soils.

The writers describe a diffusion method in which the reverse action, is eliminated, and which, therefore, gives a true measure of the direct action, but until further experiments have been made, it is not possible to determine its value for soil analysis.

(1) K and p are constants under the given conditions; c equals the concentration of the phosphoric acid in solution and y the amount of substance adsorbed. The constant K represents the tenacity with which the soil keeps the phosphoric acid and p is the manner in which the adsorptive capacity of the soil is satisfied under the conditions of the experiment.

(Ed.).

523 - **The Oxidising Power of Some Soils in Deli, Sumatra.** — HONING, J. A., in *Bulletin van het Deli Proefstation*, No. 8, Medan, January 1917.

GERRETSEN calls the number of mg. of iodine liberated by 100 grm. of dry soil from a dilute solution of potassium iodide acidified with sulphuric acid, the hydrogen-iodide value. From well mixed soil samples 2 grm. are rubbed in a mortar and washed in an Erlenmeyer flask; 5 cc. of a 1% solution of potassium iodide are added, also 6 drops of sulphuric acid (1:1). After 5 minutes the liquid is centrifuged, filtered and titrated with N/100 $\text{Na}_2\text{S}_2\text{O}_3$. After determination of the moisture the value for 100 grms. dry soil can be calculated.

By this method GERRETSEN (1) could distinguish between soils in good condition and those that are poor, and insufficiently oxidised, as the soils with a high an hydrogen-iodide value gave a rich crop of sugar or rice, and those with a low value, a small crop.

When this method of testing irrigated soils in Java was tried on dry soils in Deli, it proved to be impracticable; very often the hydrogen-iodide value was very high in samples taken at a depth of one or two feet below the surface, and very low or even nil on the surface. Moreover these soils with a very low or with no hydrogen-iodide value are not bad for practical purposes. They are black "dust-soils" with a high percentage of humus; (VAN BYLERT (2) found 7.6%), and the organic matter immediately absorbs the iodine liberated in the solution.

The very high hydrogen-iodide value of soil samples taken 30-90 cm. beneath the surface is caused, not by a higher degree of oxidation of the soil at that distance from the free air, but by the large quantity of oxidised material, i. e. ferric iron. This ferric iron is not equally divided over the whole depth but partly accumulated in thin layers, strips or patches, at some distance from the surface.

From these causes, the presence of large quantities of humus and the irregular and changeable distribution of the ferric iron, which is indeed the determining factor, the method breaks down when applied to non-irrigated soils in Deli.

524 - **The Action of some Olygodynamic Elements on Nitrogen Fixing Bacteria.** — MONTANARI, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 50, Pt. 2, pp. 66-72, Modena, 1917.

Besides the action of manganese (previously studied in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 47, p. 441) experiments have been carried out on the action of the following elements: copper, barium, zinc, lead, arsenic. Very white silicious sand from Tripalla (Tuscany) was used as basis. It was washed, first with concentrated hydrochloric acid, then with distilled water. The sand was mixed with 2% of pure calcium

(1) F. C. GERRETSEN. Het oxydeerend vermogen van den bodem in verband met het uitzuigen. — *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, deel V, bb. 317-331, 1915.

(2) A. VAN BYLERT. Onderzoek van eenige grondsoorten in Deli. — *Mededeelingen uit Lands Plantentuin*, XXI, 1897.

carbonate, precipitated and moistened with water to which had been added the necessary quantity of nutritive substances (ammonium sulphate and phosphate, potassium sulphate and magnesium sulphate). By this method the best conditions for nitrification were obtained.

The oligodynamic elements used were added either at the beginning of the experiment, at the moment of inoculation, or else after nitrification had set in and developed strongly. To 100 gr. of sand 0.01 gr. of the element was added, in the series 1-8 (see the appended table) and to the series 9 to 16, 0.05, or even 0.10 gr. of the element was added. The other conditions of the two series were identical. The experiments, carried out at the Royal Technical Institute of Mantua, lasted about 2 years.

Action of some oligodynamic elements on nitrification.

Compounds added per 100 gr. of artificial soil		Average quantities of nitrates found after addition of the elements	
		At moment of inoculation mg.	After strong development of nitrogen bacteria mg.
1	None	1.90	12.8
9	None	1.80	12.8
2	Manganese peroxide 10 mg.	1.65	12.8
10	<i>idem</i> 50*	1.30	12.8
3	Manganese sulphate 10	2.20	12.8
11	<i>idem</i> 50*	2.20	12.8
4	Copper sulphate 10	0.10	12.8
12	<i>idem</i> 50*	none	8.3
5	Barium carbonate 10	1.60	12.8
13	<i>idem</i> 50	1.10	12.8
6	Zinc sulphate 10	1.40	12.8
14	<i>idem</i> 50	traces	12.8
7	Lead carbonate 10	1.40	12.8
15	<i>idem</i> 50	0.20	12.8
8	Arsenic anhydride 10	1.05	2.0
16	<i>idem</i> 50	0.40	0.6

* 100 mg in some experiments.

The figures given in the table represent an average of at least 6 experiments. The quantities of nitrates produced are calculated in mg. of potassium nitrate per 100 gr. of dry artificial soil. These figures show that the action of some of the elements varied fairly considerably according to whether they were added at the beginning of the experiment or when nitrification was already in progress. In the first case, the addition of

copper, even in small quantities, of barium, zinc, lead and arsenic, the latter in larger quantities only, had a marked inhibiting effect. In the second case, however, owing to its vigorous development, the ferment was unaffected except by the largest quantities of arsenic and copper.

It should be noted that in none of the experiments did the various elements, even when added in the smallest quantities, have a stimulative or favourable effect on the development of the ferment. Manganese sulphate was the only exception to this rule. This accounts for the prejudicial action of these elements on nitrogen bacteria.

525. **The Use of Dog's Tooth Grass (*Cynodon Dactylon*) for Binding Shifting Sands in Sicily.** — Borzi, A., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Pt. 3-4, pp. 101-116 + 2 plates, Palermo, 1916.

Dog's tooth grass is a perennial found in all countries. It grows very easily and spreads rapidly, and is, therefore, well suited for binding shifting sands, and should be used for this purpose much more than it is at present.

The author describes its use as a binding plant in the sandy plain adjoining the sea between Cape Rosocolmo and Milazzo (province of Messina). Here, large stretches of ground, reclaimed from the sea each year and swept by strong winds, have been transformed into vineyards, orange groves and kitchen gardens by binding them together with *Saccharum spontaneum* (1) and *Cynodon Dactylon*, and, in some cases, with the latter grass alone.

On account of its shortness dog's tooth grass is not so good a protection against wind as *S. spontaneum*, nevertheless, when wild it forms compact clumps which are useful in the construction of dikes, banks and similar works and are more resistant and durable than masonry. A description is given of a case in the Staitini district, near San Filippo Archi, where this plant was used in the construction of a dam for irrigation water, measuring 98 ft. in length, 15 ft. in height, and about 7 ft. in width at the base.

The procedure for building constructions of this kind is as follows: — a large quantity of stems and rhizomes of *Cynodon Dactylon* are pulled up with a hoe. These are placed in a single layer about 8 to 12 inches thick over the site of the proposed dike. The whole is then covered with earth 8 to 12 inches deep, and pressed down with the back of the hoe or spade and the feet. The work is usually started in autumn so that the rains may cause a rapid growth of the grass. Towards the end of winter the process is repeated, a new layer of grass and one of earth being added. This second operation helps to raise the construction, but is only indispensable when the growth of the first layer of *Cynodon* is slow and incomplete. Such cases are, however, rare.

Dog's tooth grass should not be pulled up from soils it has fixed when wind and sea-water resisting trees and bushes (such as: *Pinus pinaster*,

Juniperus macrocarpa, *Tamarix gallica* and *T. africana*, *Casuarina equisetifolia* and *C. tenuifolia*, *Myoporum insulare*, *Spartium junceum*) are planted. In such cases holes should be made of sufficient depth to take fairly strong trees of the varieties chosen.

Attention is drawn to the value of dog's tooth grass as a fodder-crop.

526 - **The Rapid Increase in the Output of American Potash.** — *Commerce Reports*, No. 45, p. 728. Washington, D. C., February 23, 1917.

Greatly increased production of potash in the United States of America during 1916 is reported by the United States Geological Survey, which also expressed the belief that the output for 1917 will be much greater. The total production of potash salts and potash products in the United States in 1916 represented about 10 000 short tons of pure potash, with a net value at point of shipment of at least \$ 3 500 000 figured at the prevailing selling prices. This is ten times the value of the production reported for 1915, but the figures submitted by many of the producers represent only a start made toward the end of 1916.

The production of potash reported to date for 1916 may be summarised as follows :

Mineral sources : Natural salts or brines, 3 850 short tons; alunite and silicate rocks, including furnace dust recoveries, 1 900; total mineral, 5 750.

Organic sources : Kelp, 1 110; pearlash (mostly from hardwood ash), only 23 producers having reported to date out of a list of 70 establishments said to be producing, 220; miscellaneous industrial wastes, 1 750; total organic, 3 080.

Total output, 8 830 short tons.

The largest output has come from the Nebraska alkali lakes, but the natural saline deposits elsewhere are now just beginning to make important contributions. The figures for potash derived from alunite, of which there is only one important producer, are combined with those for available potash in cement-kiln, fluedust, greensand, and feldspar recoveries, in order not to disclose figures given in confidence. These do not include a considerable quantity of feldspar said to have been mined and prepared for possible use for the sake of the potash it contains. The production of potash from organic sources is about half that from mineral sources. The recovery of potash from pearlash is an old established industry.

527 - **Bromine Content of German Potash Salts.** — WINKLER, L. W., in *Zeitschrift für anorganische Chemie*, Year 30, Pt. 27, pp. 95-96. Leipzig, April 3, 1917.

As a continuation of his work on the iodine content of Stassfurt salts (1) the author gives the results of his experiments on the bromine content of the various German potash salts. The results are summarised in the appended table. The method by which the bromine was estimated is described.

(1) See B. 1916, No. 1167.

Bromine Content of various German Potash Salts.

Salt	Average percentage of bromine
<i>Sylvine</i>	
white, from Burbach	0.291
colourless, from Gross-Rhuden	0.360
colourless, from Aschersleben	0.261
reddish-yellow, from Vienenburg	0.117
red " "	0.118
white, from Hängsen	0.136
<i>Carnallite</i>	
red, from Sondershausen	0.171
colourless, from Burbach	0.307
reddish-yellow, from Burbach	0.188
pinkish-yellow, from Mecklenburg	0.141
commercial salt, from Werragebiet	0.187
grey, from Stassfurt	0.301
red " "	0.136
reddish, from Gross-Rhuden	0.106
red, from Aschersleben	0.111
grey, " "	0.121
colourless, from Vienenburg	0.168
yellowish " "	0.148
reddish " "	0.171
<i>Sylvinite</i>	
Grey, from Känigsen	0.085
red, from Alsace	0.131
reddish " "	0.101
<i>Harlsalt</i>	
from Burbach	0.027
from Werragebiet	0.081
<i>Langbeinite</i> from the Leine Valley	0.036
<i>Bischofite</i> from Vienenburg	0.167
<i>Tachydrite</i> from Vienenburg	0.138

From these data it may be seen that German potash salts contain a fairly high percentage of bromine.

528 - **The Addition of Tar to Calcium Cyanamide to Facilitate Spreading: Experiments made in Germany.** -- SCHMÖGGER and LUCKS, in *Mitteilungen der deutschen Landwirtschafts-Gesellschaft*, No. 10, pp. 156-157, Berlin, March 10, 1917.

Under the auspices of the Prussian Department of Agriculture experiments are carried out at the Agricultural Station at Danzig (Prussia) in order to find, if possible, a method to facilitate the spreading of calcium cyanamide. It was found that good results were obtained by mixing the manure with 15 % coal-tar.

The cyanamide is first mixed with the tar and then passed through a mincing machine. The material thus obtained is rather similar to superphosphate. It may be easily spread without powdering, a characteristic

which it does not lose even when kept for a long time. The addition of tar causes no loss of nitrogen.

In order to determine whether the addition of tar is harmful to plants fertilised with cyanamide, pot manuring experiments were carried out with oats during the summer of 1915. The plants grew equally well in pots treated with cyanamide and tar as in those treated with pure cyanamide or with ammonium sulphate, and much better than in pots without nitrogenous manure. As the experiment was commenced very late the oats only reached the flowering stage and the yield could not be controlled.

In April, 1916, a second experiment was begun. This was carried out with 10 pots divided into 5 equal groups treated respectively with the following manures:—

Group 1	No manure
Group 2	Pure calcium cyanamide
Group 3	Cyanamide + 10 % tar
Group 4	Cyanamide + 25 % tar
Group 5	Ammonium sulphate

In each pot were sown 20 oat seeds, in 5 immediately after manuring, in the other 5 a fortnight later. The pots were kept in the garden throughout the whole experiment.

Sprouting was normal in all the pots, but shortly after, the plants which had not been manured showed less vigour. During the summer it was observed that, in all the plants (also in those which had not been manured) the tip of the leaf was white. Later it ascertained that this peculiarity was due neither to a parasite (*Thrips*) nor to the cyanamide. The plants matured well nevertheless and gave the following average yields:—

	Grain	Straw
Group 1	7.1	13.0
Group 2	12.5	24.2
Group 3	12.4	23.2
Group 4	12.5	21.6
Group 5	12.2	24.1

Nitrogenous manure increased the yield by about 70 % without there being any visible difference between the various kinds. It may, therefore, be concluded that cyanamide had no harmful effect on the plants.

In 1915-16, the experiment was repeated with wheat in the open. Six plots of 614 square yards each were used. Three of these were treated with 35 lbs. of cyanamide and tar, the other 3 were not manured. Pure cyanamide was not tested. The manure was harrowed in and the seed sown immediately after. The plots, especially those which had been manured, all looked exceedingly well throughout the experiment.

Two hundred-weight of tarred cyanamide (16.7 % nitrogen) increased the grain yield by 1.04 cwt. and the straw yield by 4.07 cwt. This

relatively small increase is not surprising as the sowing conditions were particularly bad and the soil already sufficiently rich in nitrogen, and there is no reason to attribute it to the mixture of cyanamide and tar.

529 - **The Use of Lead for Stimulating Growth in Plants; Manuring Experiments in Germany.** — STUTZER, A., in *Journal für Landwirtschaft*, Vol. 64, Pt. 1 and 2, pp. 1-8, Berlin, 1916.

Experiments carried out in 1914 and 1915 on the action of aqueous solutions of lead nitrate showed that plants grew vigorously when treated with small quantities of lead. The maximum growth was obtained with 0.5 gr. of nitrate per litre of nutritive solution. Not only did larger quantities affect the development of the roots, but they also retarded that of the leaves. The same results were obtained in this respect with all the experimental plants: — rye, wheat, oats, barley, maize and peas. The difficulty of spreading the lead nitrate was overcome by making it into a fine powder and mixing it well with the potash salt or sodium nitrate used as manure.

Manuring experiments with beets resulted in a certain increase in yield of both roots and sugar which could be attributed to the lead nitrate. Potatoes, on the other hand, proved very sensitive to the action of lead which caused a decrease yield of tubers and starch.

The following table gives the results of experiments on wheat in sandy loam: —

Effect of lead nitrate on wheat yield.

	Yield per acre	
	Grain cwt.	Straw cwt.
a) Basic manure without nitrogen in the form of sodium nitrate . . .	18	20
b) Basic manure + 44 lbs. nitrogen in the form of sodium nitrate . .	21	37
c) Manure b) + 9 lbs. lead nitrate.	18	32
d) Basic manure + 66 lbs. nitrogen in the form of sodium nitrate . .	22	38
e) Manure d) + 9 lbs. lead nitrate	25	44

The results obtained lead to the following conclusions:

1) The addition of 44 lbs. of nitric nitrogen to basic manure increased the grain yield by 880 lbs.; 56 % of this nitrogen was assimilated. The addition of 9 lbs. of lead nitrate only increased the grain yield by 187 lbs. as compared with basic manure, and only 21.5 % of the nitrogen was assimilated.

2) The addition of 66 lbs. of nitric nitrogen to the basic manure increased the grain yield by 1320 lbs., and 82.3 % of the nitrogen was assimilated. In this case the addition of 9 lbs. of lead nitrate had a favourable effect on the grain yield, which it increased by 2123 lbs. as compared with the basic manure.

It was not possible to prove the extent to which atmospheric conditions influenced this result. It is, however, thought probable that the action of the lead nitrate depends on the state of nutrition of the plant, and that, in subsequent experiments with stimulants, particular attention should be given to determining the limit at which lead nitrate reaches

its greatest efficiency as compared with the state of nutrition of the plant. In the soil, lead nitrate is converted into sulphate and carbonate, which dissolve with difficulty. They are, however, very finely divided (in the hydrated state) and well distributed, so that the efficiency of the lead is preserved.

There is nothing against the practical use of lead nitrate, and, so long as the manufacturer can guarantee a uniform distribution of the lead, the mixing of lead nitrate with potash salts and sodium nitrate on a commercial basis is recommended.

130 - **Useful Plants found in the Columbian Republic, Central America.** — BRAVO, JORGE E., in the *Revista Nacional de Agricultura*, Year IX, Series XII, Nos. 148-149, pp. 911-951, 492-1006. Bogotá, October-November 1916.

CEREALS: — All do well in Columbia, especially maize, which is native.

TUBER AND ROOT CROPS. — Columbia is very rich in these crops; the principal native varieties are: — "papa" (*Solanum tuberosum*); "arracha" (*Arracacia xanthorrhiza*, = *A. esculenta*); "batata" (*Ipomoea batatas*); "yuca" (*Manihot utilisima*); "saqui" (various species of *Maranta*); "taberna" (*Dioscorea sativa* = *D. Cliffortiana*); "madafa" (*Colocasia antiquorum* = *C. esculenta*); "achira" (*Canna edulis*); "ibias" (*Oxalis tuberosa*); "chugus" (*Bevac tuberosus* = *B. Kunthii*).

FIBRE CROPS: — Cotton growing is progressing rapidly in Columbia. There is a native gossypium variety which is perennial and very productive. It yields a cotton which, though little longer, is of excellent quality. The following crops are also grown: — "maguey" or agave" (*Agave americana*), "pita" (*Agave* spp.), etc. (See also under PALMS).

Oil PLANTS: — Many fruit trees and palms yield oils and vegetable fats (see under these headings). Particular mention should be made of the following: — "caparrapi" or "ardecocite" (*Laurus esculata*), which gives an oil used for medicinal purposes; "laurel olio" (*Guaiacum parviflorum*) and "laurel aguacatillo" (*Guaiacum longifolium*), which gives a kind of wax or vegetable tallow with which soap and candles with a pleasant natural scent are made; "otovo" or "carafio", which yield the "otovo" and "carafio" medicinal fats; etc.

SAPOIN PLANTS: — "chubimbo" (*Sapindus saponaria*) and "friga platos" (*Sapona-*ria) should be mentioned. Besides saponin, both give a wood of fairly good quality.

PLANTS YIELDING DYES: — Many plants containing colouring matter are found in the country, but the names of many of them are unknown. Amongst those which have been best studied are: — "brasil", "achiote" (*Bixa Orellana*); "campeche" (*Hamamelis campechiana*); "tinte", "drago" (*Croton gossypifolius* = *C. sanguifolius* and *Croton edulis* = *C. sanguis-draconis*); "divilivi" (*Caesalpinia Coultaria* tricolor), "mora" (*Bauhinia tinctoria* = *Machera tinctoria*); "azafrán" (*Sedalia asperifolia*); "añil" (*Indigo tinctoria*); "cusculá"; etc.

RUBBER, GUM AND RESIN PLANTS: — The wild forest plants (most of which are as yet unexamined from a botanical point of view) produce a rubber of excellent quality, which is exported chiefly to Brazil, Venezuela and Peru. Among the resin plants, special attention should be drawn to the "anime" (*Polymnia pyramidalis*), which produces an abundant flow of the transparent resin which burns with a smell of incense.

STIMULANT, AROMATIC, NARCOTIC, MEDICINAL AND POISONOUS PLANTS: — Columbian products of a high quality, more particularly that of the eastern zone, in the watershed of the Amazon, and has a very delicate aroma. The cocoa is also distinguished by its quality.

The commercial use of "sarrapia" (*Dactyloctenium aegyptium*) and vanilla (*Vanilla planifolia*) of recent origin and has a great future before it. Many other varieties might be used for the extraction of aromatic essence.

"Guaco" (*Mitania amara* = *M. guaco*) should be placed in the front rank of MEDICINAL

PLANTS. "Guaco" contains a febrifugal alkaloid which both prevents and cures the poisoning arising from the bites of serpents and other poisonous animals. The following plants are also found:—various species of cinchona; cassia; "gualanday" (*Jacaranda Carib.*); coca; "ipicacuana" (*Uragoga granatensis* = *Psychotria specuana*?); rhubarb; "arnica" (*Senecio crebifidolus*); "matico" or "cordoncillo" (*Piper [Artanthe] Breideneyeri*); "alco" or "acibar"; "aconite"; "sema"; "jaboraudi"; "digitalls"; opium poppy; etc. "agñe" (*Vitis caribaea* = *V. tiliacifolia*) and the "batatillo" (a species of *Aristolochia*) give a medicinal sap; the "perico" and the "suncie" give a milky sap whose composition is very similar to that of cow's milk; etc.

The Columbian flora is also very rich in POISONOUS PLANTS; some of the most toxic are the "manzanillo" (*Hura crepitans*); "barbasco" (*Piscidia Erithrina*), whose branch crushed and thrown in the water, thus killing the fish, are used for fish poisoning; "caviva" (*Pteroloma Valdivia*), whose fruit is poisonous; "borrichero" (*Bugmansia lutea*), whose fruit, when macerated, yields a tasteless liquid which, when drunk, causes top-anaesthesia, loss of mental faculties and death.

FRUIT TREES:—These are divided into groups according to whether they are useful; their wood or not:—

HARD-WOOD FRUIT TREES:—"Algarrobo" (*Hymenaea Courbaril*), "yolombo" (modified Myrtaceae), "coco de mico" (*Leathys longifolia*), give fruit with very hard shells as utensils, and wood (especially that of the first variety) used in the manufacture of machinery; "caña fistula" (*Cassia moschata*) and "tamarindo" (*Tamarindus indica*) give wood of a superior quality; the orange, lemon and citrus trees give a fine yellow wood; "arrayabo" (*Psidium dulcam*), "arrayán" (*Myrtus microphylla*), "guayabo negro", "guayabo arrayán", "guayabo acro" (unspecified Myrtaceae), "niguito" (*Melastoma lucayanum*), "mortiño" (*Ardisia latifolia*), "mirto" (various Myrtaceae) "caimo" (*Lucuma Esca.*), "caimito" (*Physalis latifolia*), besides a fruit which is moderately appreciated, also give wood of excellent quality. Of the shrubs, the pomegranate and coffee tree supply a good wood.

SOFT-WOOD FRUIT TREES:—"cacao" (*Theobroma Cacao*), "matalotaje" (unspecified Malvaceae); "masiroño" (*Rhacoma madraeni*); "cirpe" or "camairón" (*Pourouma sp.*) which has an exquisite wild fruit growing in large black clusters; if cultivated this fruit can be used for the production of a fermented drink similar to wine; "aguacate" (*Persea caribaea*); "nispero" (*Achras Sapota*); "mamey" (*Asimina Bearlandia*); "chirimayo" (*Alchornea molle*); "anon" (*Annona squamosa*); "guanabano" (*Annona muricata*); "toco" (*Artocarpus dendrocinerosus*), from whose nuts a very delicate vegetable butter may be extracted; "mango" (*Mangifera indica*); "guano" (*Ficus sp.*); "pomó" or "pomarosa" (*Gliricidia jambos* = *Jambosa vulgaris*); "morera" (*Morus sp.*); "castaño" (*Esculetia rostrata*); "coco" (*Ficus caribaea*); "almendro" (*Lernandula ulappay*); "moro" (*Uncariaudum aculeata*); "mamoneillo" (*Melicocca bijuba*); "árbol del pan" (*Artocarpus incisa*); "cirale" (*Artocarpus purpurea*); "hola" (*Sonchus latifolia*); "totumo" (*Crescentia cujate*); "huevo" (*Croton sebiferus* Jacq.); "tomate de árbol" (*Solanum elaeagnifolium*); "perillo" or "árbol de la vida" (unspecified Apocynaceae); "olivo" (*Myrica polycephala*); "corate" (*Homalium neriifolia* B. Breideneyeri); numerous other fruit trees.

All the European fruit trees may be successfully cultivated in the temperate zones of Colombia.

FRUIT TREES NOT USED FOR THEIR WOOD:—The most important of these is the "tano" (*Musa paradisiaca*), whose green parts may be used as a food for cattle. Other numerous other trees of this class may be mentioned:—"papeya" (*Carica Papaya*); "payelo" (various Arlele), "uuito" (*Nertera depressa*); "piñón" (various Bromeliads); "piñuela" (*Karwins Plumieri* = *Bromelia Caribaea*); "uchulón" (*Phyllanthus ferrugineus*); "tapia" (unspecified Cactae); "durumocón" (*Saurauja urina*); "granadilla" (*Passiflora ligularis*); "gulupus" (*Lassonia binnaestipula* = *Poggenortia rosea*); "pitahaya"

jous Cacti); "moras" (*Conostegia* spp.); strawberry plants; melons; various Cucurbitaceae "apayamas"; "calabazas", "vitorias").

TIMBER TREES: —

TREES WITH WOOD OF GREAT HARDNESS: — "Tibar" (*Escallonia discolor* = *E. Tubar*), Saxifragaceae with a dark red wood which polishes beautifully; when buried, this wood resists the action of soil agents for centuries; "guayacán" (*Guaiacum [Lycophyllum] arboreum*), with a reddish-brown wood with lighter streaks; it has the same characteristics as the preceding tree; "diomate" or "marfil vegetal" (*Astronium graveolens*), which gives a wood of a fine dark red with black stripes, which polishes well; the wood neither cracks nor warps, is not attacked by insects and does not rot; "istapa" or "árbol piedra", an undetermined species with a dark yellow wood; "huesito" (*Banara ibaguensis*); "zápan", an undetermined species which gives a beautiful lemon-yellow wood with undulating red and pink bands; "arillo", unspecified Leguminosae with a dark red wood; "arcanillo" (*Hura crepitans*).

TREES WITH WOOD OF A HARDNESS EQUAL TO THAT OF THE OAK: — "Comino" (*Atenea cutilis*), a Lauraceae which supplies one of the best woods for general purposes in Columbia; is of a greenish-yellow colour and may be used for cabinet-making, furniture-making and heavy sleepers, etc.; "Caunce" (*Gouaya antioquiensis*), a Lauraceae whose wood is perhaps the most flexible known; it is yellow and polishes well; "Punte" or "nocuito", an undetermined species, its wood of a reddish-brown does not rot, and is used in the construction of very durable fences; "laurel caño" (*Xylosma prunifolium*), a Bixaceae which supplies one of the most useful woods for mining districts, where it is used in the manufacture of utensils for mining gold and for many mining tools; it neither cracks nor warps when placed alternately under water and in the sun; "Mangle" (*Rhizophora mangle*), "encenillo" (*Wicmannia tomentosa*), "moro" (not identified), "roble" (*Tabebuia [Tecoma] pentstemonifolia*), all have not only very strong and resistant wood (unfortunately subject to cracking and warping), but bark which is used for the extraction of tannin, in which it is very rich.

TREES WITH WOOD OF A HARDNESS EQUAL TO THAT OF THE AMERICAN PINE: — "Macolla" or "caoba" (*Surirena Mahagoni*); "cande" (unspecified Bignoniaceae, with reddish-brown wood) and "mogal" (*Cordia Neesii*), much used in cabinet-making; "cedro" (*Guia odorata*) and "plano colombiano" (*Podocarpus taxifolia*), used for land and sea building-purposes and as timber; "caña gallo" or "pata de gallo" (*Psaronius [Libaudia] latifolia*), specially adapted for the manufacture of utensils for holding liquids; "limoso" (unspecified Melastomaceae) of a beautiful lemon-yellow colour; "tuno" (*Delestenia [Colajnia] sp.*); "espiño" (*Barrandesia spinosa*); "chagualo" (*Calophyllum lanceolum*) and "yayo" (*Lichilia appendiculata*), which make excellent beams for building purposes; "limale", which makes very good beams; "pimiento" or "muelle" (*Schinus molle*); "olito" (*Myrsine pofayensis*); "eucalipto" (*Eucalyptus* spp.); "alecaparro" (*Cassia aculeata*); "chaparro" (*Curatella americana*); "sicomoro" (unspecified); "abeto" (*Pinus* spp.); "olmo" (*Ulmus campestris*); "susea" (unspecified); "quichalarrigo" (*Albizia splendens*); these last ten varieties produce ordinary wood which may be used for general purposes; "ceiba" (various Bombacaceae, very abundant in the Columbian flora) and "arashi" (*Macaranga rhinoceros*), whose wood makes very good paper; "guaseo" or "mucoso" (unspecified Combretaceae) and "coco de atar", whose bast, cut into strips and "guaseos", is used as straps and for buildings houses with thatched roofs; "saúce" (*Ficus mucronata*); "higuerón" (*Ficus antioquiensis* = *F. glabrata* and other related species); many other trees giving ordinary wood which is much used.

TREES WITH VERY SOFT WOOD POSSESSING SPECIAL PROPERTIES: — "Balso" (*Ochromolaena*), a Sterculiaceae supplying a wood whose density does not reach 0.100, and is used for building rafts; it also yields a vegetable wool used as stuffing; "bucano" (*Artocarpus umbrosa*), an excellent shade tree for cacao and coffee plantations, etc.

PALMS: — "Coco" (*Cocos nucifera*), "copozo" (*Elaeis melanococca* = *Alfonsia elaeiaca*), "curatay" (*Martensia caryotricha*), "chonta" (*Bactris elatior*), "cucuco" (*Attalea amyg-*

dalina = *A. nucifera*), "cahlpay", and "cucurito", yield fruit and oils; "dátil" (*Phoenix dactylifera*) and "palmicho", bear fruit; "tagua" (*Phytelphas macrocarpa*), gives a vegetable ivory the exportation of which increases continuously; "palma de cera" (*Ceroxyle andicola*) produces a vegetable wax; the very long, straight, hollow trunks are much used as water pipes; "noli" (*Elaeis oleifera*?) supplies the best balt; "cunare" (*Baccharis setosa*) supplies the finest and most beautiful vegetable fibre known, used in the manufacture of very fine and durable linens; "imeca" (*Carludovica palmata*), the fibre of which is used in the manufacture of true "panama" hats; "macana" (*Brunfelsia Hopeana* = *Franciscana uniflora*) with black wood, and "corneto" (*Iriartea cornuta* = *Beckeria cornuta*) sometimes reach height of 180 feet; "palma cobija" or "blauera" (*Copernicia tectorum*), "moriche" (*Mauritia flexuosa*), "sarure" or "saray", "eubarro", "palma amarga" (*Oreodoxa olivacea*), "mapora" (*Tritirina mapora*), "palma real" (*Oreodoxa regia*), "Santa Inés", "palillaca do" (*Carludovica Wallisi*), "palma de vino" (*Cocos butyracea*), and many other varieties give wood which is used for building and fruit used for fattening pigs.

Some ARBORESCENT FERNS, especially the variety called "boba", supply stakes useful in building.

531 - Hybrid Origin of Cultivated Lucerne. - TRABUT, in *Comptes Rendus de l'Académie des Sciences*, Vol. 164, 1st. Half-Year, No. 16, pp. 607-609, Paris, April 16, 1917.

The value of *Medicago sativa* Linn. as a species has been considered from various points of view. Certain botanists, struck by the great number of forms intermediary between lucerne and *Medicago falcata* place *Medicago sativa* and *M. falcata* Linn. in one species. This has caused *M. falcata* to be considered as the wild form of lucerne. It is admitted nowadays that the two Linnaean varieties are quite distinct but connected by a series of fertile hybrids which are capable of reproduction with a certain fixity.

The study of the *Medicago* members of this group which grow wild in North Africa, and of many cultivated forms grown at the Botanical Station of the Government of Algeria, has lead the author to a different conclusion:

All cultivated lucernes are of hybrid origin. *Medicago sativa* Linn. properly so called, does not exist in the wild state. In the north of Africa, Asia Minor, southern Russia, the Caucasus, Persia, Afghanistan and part of India, there are species of *Medicago* which, though always considered as the wild form of *Medicago sativa*, are, in reality, one of its parents. In Algeria these species are represented by *M. getula* Urdon and *M. tunetana* Murbeck.

The cultivation of these wild lucernes gives plants which have only a medium feeding value. The flowers vary in colour and may be yellow, blue, pink or white. As they usually grow in districts very different to those in which lucerne is cultivated, in shallow soil, on tufa, the roots are not very deep, and the plant gives off rhizomes which are sometimes of great length; this never occurs in cultivated lucernes.

Medicago falcata does not exist in the north of Africa; it has, therefore not been produced by hybridisation, and *Medicago getula* and *Medicago tunetana* have been kept pure.

Since the colonisation of the Setif plain, however, *M. getula* has come in contact with cultivated lucernes and reciprocal fertilisation has been

inevitable in some cases. This has resulted in a local lucerne called "Seed lucerne" (1). This would explain how Mr. W. OLIVER of the United States Department of Agriculture Bureau of Plant Industry was able to isolate about 50 forms of lucerne from *Medicago sativa* seeds gathered in the Setif district.

Plants grown by the author from seeds gathered at a distance from cultivated fields, sometimes at a height of 6000 feet, in the Aures, only gave progeny which were identical with the parents, of weak growth and of little use as fodder.

Medicago falcata, together with the secondary forms, *M. ruthenica*, *M. glutinosa* and *M. platycarpa*, is a more northern form. It is, however, found over a very wide area, and, in some districts, might easily coincide with the *Medicago* generally held to be the wild form of *M. sativa*. It is probably the hybrids, whose growth is often very luxuriant, produced by the contact of these two varieties, which have been cultivated and have naturally become *Medicago sativa* Linn. The forms most closely related to *M. falcata* have been classified by PERSOON under the name of *Medicago media*.

Uncultivated forms of *Medicago media* are abundant in the valley of the Loire, where the true *M. falcata* is not found. Some of these are difficult to distinguish from cultivated lucerne, and it is probable that they are derived from cultivated *Medicago sativa*.

If cultivated forms of lucerne are carefully studied, a great difference between them is seen at first sight, and traces of the influence of *M. falcata* found in practically every variety.

This hybrid origin of cultivated lucerne explains the great facility with which it varies in different climates and rapidly forms local varieties with very diverse characteristics.

At the above-mentioned Station, Arabian lucerne (2) flowers very early, that an extra harvest is obtained. Peru lucerne (3) is also very early. Pakistan lucerne (4) is composed of very diverse individuals, which should be isolated; it gives a very medium yield. In Australia (5) lucerne has already formed a local variety whose yield is very superior to that of recently imported seed of the same origin.

If it is desired to obtain seed of a selected variety of lucerne, the work must be carried out in a district where neither *Medicago falcata* nor *Medicago sativa* exist in the wild state. In order to form a field of stock plants, cuttings may be taken from selected individuals; by this method the necessary seed for more extensive sowing is soon obtained. By isolating varieties of *Medicago sativa* the cultivation of this valuable fodder plant would be greatly increased. In cold or barren districts, *Medicago getula* could be used in

1) See B., 1912, No. 655.

2) See B., 1912, No. 655.

3) See B., 1915, No. 138.

4) See B., 1911, No. 415.

5) See B., 1915, Nos. 408 and 1033.

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crossing and would transmit to some of its progeny its peculiar characteristic of giving off rhizomes.

An attentive and prolonged study should also be made of *Medicago falcata* and the hybrids which resemble it most closely in order to obtain new forms for use more particularly in northern countries.

In short, the experimental study of wild and cultivated varieties of lucerne shows that, in the wild state, there are 2 primitive species, *Medicago falcata* and *Medicago getula*; the latter is known under other names which may be considered synonymous (*M. coerula* Less. and Lebed; *M. contorta* Gib.; *M. tunetana* Murbeck). *Medicago sativa* Linn. is descended from these two wild types by hybridisation; it includes all the innumerable forms intermediary between the 2 wild varieties and, with proper care, should supply very numerous varieties of lucerne capable of giving profitable yields under varying soil and climatic conditions.

532 - **The Formation and Disappearance of Saccharose in the Beet.** — COLIN, H. in *Revue générale de Botanique*, Vol. XXVIII, Parts 334, 335, 336, pp. 289-299, 322-327, 368-380; Vol. XXIX, Parts 337, 338, 339, 340, pp. 21-32, 56-64, 89-96, 111-127. Paris, 1916-1917.

The author has studied the problem of the formation and distribution of saccharose in the beet in the light of data obtained from scientific literature and his own observations. The following essential facts are either established or confirmed: —

1ST. YEAR BEETS.

The leaf invariably contains a mixture of saccharose and reducing sugar composed of glucose and laevulose. Laevulose is more abundant than dextrose in the tissues of the blade, but in the petiole, especially at the base, glucose is present in greater quantities than laevulose.

The saccharose seems to originate in the leaf cells exposed to the light. In darkness it disappears after being transformed into invert sugar by the action of the sucrase which is always abundant in the blade. The ratio of saccharose to reducing sugar decreases continually from the blade to the neck, so that, in the immediate neighbourhood of the root, the sugar present in the petiole is composed of a small quantity of saccharose and a large proportion of reducing sugar, mostly glucose. There is always a large amount of reducing sugar in the stump, but it varies according to the variety of the beet, being greater when the root is young.

With regard to the origin of the sugar in the root, A. GIRARD's theory of the migration and storing of the saccharose as such has been proved unsound, 1) because the stump always contains reducing sugar, 2) because the disappearance of the saccharose from the leaves during the night is not necessarily connected with its migration towards the stump. LOEB's indirect argument in favour of the same hypothesis is based on the absence of a synthesising ferment in the stump. This can only be seriously considered if it is first proved that all polymerisation in the living tissues involves the action of a ferment. The theory of the polymerisation of the reduc-

ing sugar in the root has not yet been conclusively proved, and many difficulties stand in the way of its acceptance. The chief of these is the sudden change observed in the composition of the sugar mixture when the neck is first invaded. This proves that only a small number of the cells of the neck participate in the condensation of the reducing sugar.

There are no data as to the change the reducing sugar undergoes in the root. This condensation cannot be due to the action of a synthetic enzyme, e.g. sucrase, as, under normal conditions at least, invertine is absent from the root.

2ND. YEAR BEETS.

Under certain conditions the sugar may leave the stump and ascend towards the aerial parts. This occurs, for example, when the beet grows in darkness, and especially in the second year when the stem is forming.

The saccharose does not at any moment hydrolyse in bulk in the interior of the stump, but the amount of reducing sugar remains perceptibly constant so long as the tissues are intact. The saccharose, when it migrates, leaves the root as saccharose and is gradually inverted as it comes in contact with the cells of the stem, the petioles and the blades. Thus the ratio between the saccharose and the reducing sugar decreases almost regularly from the neck to the top of the inflorescence.

PRACTICAL CONSIDERATIONS.

The conditions under which the sugars develop in the leaves and the circumstances which favour the growth of the beet and its richness are still insufficiently defined. No systematic experiments have yet been carried out which allow the classification of the 3 factors, moisture, heat and light, in order of the importance of their action on the growth of the beet. All that is known is that the beet is richer in East Prussia and Holland than in Italy and Hungary, and the beet may, therefore, be said to be a northern plant. It is, moreover, impossible to state wherein lies the great difference between a sugar beet and a mangold. The root of the mangold is larger, poorer in saccharose, but richer in reducing sugar. The phenomena of development and of the accumulation of sugar are, however, essentially the same in both cases.

The peculiar properties of different varieties of beet have frequently been attributed to the leaves alone. As a matter of fact, the tissues of the stem also vary, whereas leaves of different varieties often contain the same amount of reducing sugar and saccharose.

In selection the roots richest in sugar are chosen for propagation. This is in agreement with the method always adopted in selection; the subjects showing the highest development of the required characteristic are chosen for reproduction.

Comparative data on the formation of saccharose in other plants are given.

533 - **The Influence on Germination of the Hot Water Treatment of Cereal Seeds for Smut.** — LAKON, GEORG, in *Zeitschrift für Pflanzenkrankheiten*, Vol. 27, Pl. 1, pp. 18-25. Stuttgart, February 15, 1917.

The experiments described were carried out in order to determine the effect, if any, of the treatment of seeds with hot water against smut on their germinating power, apart from the effect on the smut itself.

The germinating capacity of untreated barley at ordinary temperature on blotting paper was first determined; it was as follows:—

	Germinating capacity after		
	3 days	10 days	14 days
Experiment I	23 %	94 %	57 %
Experiment II	19 %	93 %	97 %

At a lower temperature (10-12° C.) the germinating capacity of the same barley was:—

	Germinating capacity after		
	3 days	10 days	14 days
Experiment III	50 %	99 %	99 %
Experiment IV	59 %	99 %	99 %
Experiment V	57 %	98 %	98 %

Germination is, therefore, more rapid and better at the lower temperature than at ordinary temperature. These experiments show that the embryos of the seeds were only incompletely ripe.

The determination of the growing capacity (Triebkraft) of the same barley gave the following values:

	Growing capacity
Experiment VI	76 %
Experiment VII	72 %

A sample of the same barley was treated with hot water and the seeds germinated while still moist. The germinating capacity was:

	Germinating capacity after		
	3 days	10 days	14 days
Experiment VIII	13 %	84 %	87 %
Experiment IX	18 %	84 %	88 %

In 3 other experiments the seeds were dried after being treated with hot water; in two cases germination took place at normal temperature in the 3rd., at a lower temperature. The results were as follows:

		Germinating capacity after		
		3 days	10 days	14 days
Normal temperature	Experiment X	78 %	97 %	98 %
	Experiment XI	83 %	95 %	96 %
Lower temperature	Experiment XII	74 %	94 %	95 %

CONCLUSIONS. — 1) In all cases treatment with hot water increased the germinating capacity.

2) In spite of the increase in germinating capacity, the final result of the germination of moist seeds was much inferior to that obtained with seeds which had not been treated.

3) Seeds dried after treatment with hot water and germinated at ordinary temperature showed a germinating capacity not usually found in German barleys; the final result of germination corresponded to that of untreated seeds. Lower germinating temperature had an unfavourable effect on the germinating power.

4) Soaking the seeds after drying can, therefore, eliminate the phenomena which arise from incomplete maturity; treated seeds behave in a similar way to very ripe seeds.

The growing capacity of the seeds treated was also determined and gave the following results:

	Growing capacity
Experiment XIII, with moist seeds	21 %
Experiment XIV, with dried seeds	63 %

If the moist seeds are sown immediately after soaking the growing capacity is impaired. Most of the few plants which put out shoots did not live owing to defective development of the roots. On the other hand, seeds dried after soaking were remarkable for their strong growth, which, however, was still inferior to that of unsoaked seeds. The experiments on the growing capacity of the plants have a relative value only.

To sum up, the treatment of the above mentioned unripe barley with hot water followed by drying, greatly increased the germinating capacity, but slightly decreased the growing capacity.

For purposes of comparison ripe barley of the same variety was treated with hot water. A considerable decrease in germinating capacity and a marked deterioration in the final results of germination were observed. The growing capacity had also decreased.

94. — **Oxidation and Reduction Phenomena in Plant Tissues.** — I. WOLFF, JULES, Mechanism of the Reaction; II. WOLFF, JULES and ROUCHELMANN, NADIA, On the Presence in a Large Number of Plants of a Diphenol greatly resembling Pyrocatechine. — *Bulletin de l'Institut Pasteur*, Vol. XXXI, No. 2, pp. 25-35: 26-30 + III plates. Paris, February 1917.

I. — The author shows how a blue reaction may be obtained in the presence of pyrocatechine, laccase and acetic acid by the use of potassium iodide and starch. This blue colouration is due neither to the presence of peroxides nor to that of nitrites, but is the result of a complex phenomenon in which a phenol compound plays the principal part.

II. — In a large number of plants was found a phenol compound, which, in the presence of laccase, acetic acid, and potassium iodide and starch, had an action similar to that of pyrocatechine, with which it also had other properties in common, such as: 1) the formation, with dilute ferric perchloride, of a blue-green precipitate turning to violet on the addi-

tion of a drop of ammonia; 2) red colouration with Millon's reagent; 3) no oxidation or reduction in the presence of tannin; etc.

The blue reaction can rarely be observed in the vegetable tissues or juices by the direct use of an iodine reagent. This is due to: 1) the too rapid and complete oxidation during the pounding of the oxidable substances of the plants under the influence of their own laccase; 2) the presence of traces of tannin which inhibit the reaction.

In order to avoid as far as possible these inhibitory influences, a method was devised by which the oxidation of the phenol compound (choromgene) by the laccase during pounding was prevented and the active substances in the juice set free. To attain this end the pounding was carried out in the presence of a weak solution of sulphuric acid, which prevents the action of the oxidase.

By this method 229 species belonging to 59 families were tested, and the results are summarised in table form. From the results obtained it seems that: 1) vegetable juices contain no peroxide; 2) to obtain a positive result the presence of an oxidase — laccase — is required.

The experiments led the authors to the following general conclusion: "In face of the numerous discussions on the existence of peroxides and nitrites in plants and the eventual harmful action of peroxides, we consider it useful to show that, in the majority of cases, the reaction in question is due to the presence of a phenol compound (probably pyrocatechine). Together with the laccase of GABRIEL BERTRAND, this plays an important part in the phenomena of oxidation and reduction in plants".

535 - **Pure Lines in Self-Fertile Plants Probably Unalterable by Selection.** — DEWORTH, C., in *The Journal of Heredity*, Vol. VIII, No. 2, pp. 9-13, 1 fig. Washington, D. C., February 1917.

The truth of JOHANNSEN'S statement that selection is powerless to change the hereditary factors in a pure line, was called in question by BELLING (1) CASTLE (2) and by A. and C. HAGEDORN (3), but it has been confirmed by the experiments of the writer. The latter has studied 7 kinds of characters:

A. -- External characters showing qualitative variation (*Phaseolus vulgaris*, *Sinapis alba*) or small quantitative variations (*Pisum arvense*, *Lens esculenta*).

B. -- External characters showing very large quantitative variations (oats).

C. -- Internal characters showing very large quantitative variations (oats).

The plants studied were always bagged before flowering in order to insure self-pollination. The following is a summary of the most important results:

1) The variety of *Lens esculenta* known as the "Krainer Linse" (Carniola lentil) produces on the same plant 2 types of seed: a) of a uniform

(1) Cf. *American Breeders' Magazine*, III, p. 311.

(2) Cf. *The Journal of Heredity* V, p. 93.

(3) Cf. *American Breeders' Magazine*, IV, p. 165.

brown colour; b) brown spotted with black. In 8 generations of selection, the writer failed to isolate plants with seed of one type; nor did he succeed in altering the proportion of the two types of seed.

2) In 9 generations of selection, similar results were obtained with a variety of *Vicia sativa* bearing both green and creamy seeds.

3) The Green Chevrier variety of *Phaseolus vulgaris* ("Snap bean") produces 3 types of seed on the same plant: a) entirely green; b) entirely white; c) green and white. In 9 generations of selection, the writer did not succeed in increasing the percentage of whole green seeds.

4) In 10 generations of selection of a fodder pea (*Pisum arvense*, called in the United States the "Canada pea") which has yellowish-green seeds with sometimes a touch of violet, it was found impossible to obtain a larger proportion of seeds with the violet tinge.

5) In 6, 7 and 8 generations of selection of the Puy lentil (*Lens esculenta*) bearing green seeds marbled with black, the marbling being sometimes so intensified as to produce an almost solid black seed, the writer failed to obtain plants which would transmit the full black colour of the seeds, or even an intensive marbling; nor did he succeed in preventing seeds with intensive marking appearing from time to time in the case of plants producing usually only normally marbled seeds.

6) *Sinapis alba* has normally light yellow seeds but some plants bear brown seeds, and others seeds of both colours. It was not possible in 6 generations of selection of plants with seed of one colour to establish full heredity of either of the colours.

Here were 6 careful and persistent attempts to change the character of a pure line by selection of variations in one direction. Therefore the pure lines seemed to be unchangeable by selection.

B. — In the "Fichtel Mountain" variety of oats the outer kernel may bear a bristle, and the basis of this kernel, the callus, may bear many long hairs or very few, short ones. These two characters, "bristled" and "haired" are easily and widely modified by external conditions and can only be described by giving percentages per plant, the mean of a large number of plants of a variety or breed, or line, being determined.

By means of selection in opposite directions, the writer tried to intensify the mean percentage of bristled or haired outer kernels on the one hand, and to diminish it on the other. Starting with a plant with 5.11 per cent of bristles, he obtained after a series of 8 selections (+) a percentage of 3.14 and after 8 selections (—) a percentage of 2.65%. These results, however, are only positive in appearance, for a change in the hereditary factors, if it were produced through selection, ought to augment from year to year, if the selection is continued, and the values corresponding to the 2 series (+) and (—) should always deviate more one from another; this, however, was not the case.

C. — In order to study a so-called internal character, the writer examined in oats the percentage of 2-kernelled spikelets per plant. By selection for 6 generations, he proved that it was impossible to obtain 2 groups of

individuals with a larger or smaller percentage respectively than their parents.

Here, as in the preceding experiment, values are sometimes obtained which would seem to show that the selector's efforts had actually been effective, but these variations appear in one generation and do not increase in succeeding generations, as they would do, if it were a case of a real change in the hereditary factors.

Similar results have been obtained by KRIESSLING (at Weißenstephan, Bavaria), who after 5 generations of pure-line selection, failed to increase, or diminish, the protein content of two-rowed barley.

536 - **The Selection of Sea Island Cotton (*Gossypium barbadense*) in the United States.**—ORLOW, W. A., in *United States Department of Agriculture, Farmer's Bulletin*, 787, pp. 1-40 + 13 fig. Washington D. C., 1916.

Sea Island cotton is remarkable for the length and fineness of its staple. It is grown extensively in the southern states of Florida, in Georgia, and on the south eastern coasts of South Carolina, where it was introduced for the first time, in 1786, from the West Indies.

Originally this cotton plant was perennial, more developed and less productive than it is to day. Intense selection has radically changed its characters, and has resulted in the formation of a cotton which is really superior to the "Upland" types. The variability, which leads to the great improvement in Sea Island cotton, necessitates the uninterrupted continuation of this work in order to prevent the degeneration of the plantations. The following method, based on the principle of individual selection, has been advantageously adopted:—

1st. year:— Those plants are chosen which answer best to the types to be created or preserved. Preference should always be given to plants with the following characteristics:

a) Close branches, from 3 to 5 feet long; main stem strong, with 2 or 4 head branches bearing bolls.

b) Four-celled bolls, long, compact and full to the top; they must not be too pointed. The plants whose bolls open too widely should be eliminated as this character is in correlation with short staple.

c) Staple at least 1 cm. long, strong, as uniform as possible in colour and diameter.

d) Early or late types, according to local conditions. Very early plants give a rather lower yield than late ones, which, however, in unfavourable climates, are exposed to the danger of autumn frosts before ripening.

e) Plants which are resistant to the most serious and wide-spread diseases of the district. The Rivers variety has been isolated by selection and is to be recommended on account of its great resistance to *Fusarium vasinectum* Atk.

Once the best plants are chosen they are labelled with a number. During the harvest the yields of each plant are compared, and the best satisfactory set aside, the fruit of about 10 to 25 plants only being kept.

2nd. year:— The seed of these 10 to 25 plants are sown separately in lines in a field surrounded by some other crop (maize, for instance), so as to prevent the pollen of other plants (Upland varieties) from being introduced.

The best line is then chosen on the basis of uniformity, but always taking the other above mentioned characters into consideration.

The seed of the other lines is collected together and forms a good stock for ordinary purposes.

3rd. year: — The seed of the best line is sown on a special plot, and the material obtained will be used the following year as "selected seed" for general cultivation.

4th. year: — The plantations must be kept in good condition, plants of little value being removed so that only the best may be kept and propagated.

Selection should form part of the customary routine of cotton growing in the same way as manuring and the cultivation of the soil.

537 - **Cotton Selection in Sicily, Italy.** — See No. 545 of this Bulletin.

538 - **Seed Selection in the Cultivation of *Hevea Brasiliensis*.** — CLAYTON, BEADLE and STEVENS, HENRY, P., in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 1, pp. 1-24, London, 1917.

In response to the enquiry of the Rubber Growers' Association as to the possibility and probable importance of seed selection in the cultivation of *Hevea brasiliensis*, the Association's resident officers in the East collected the practical and interesting data given in the above-mentioned bulletin. In the cultivation of *Cinchona*, the yield of quinine from the bark has been raised from about 3 per cent to 7 per cent, or more, as the result of planting from the seed of trees whose bark yielded a high percentage of alkaloids. Can a similar method of seed selection be applied to *Hevea brasiliensis* in order to increase the yield of rubber? The following is a summary of the most important answers to this question.

1) Planters are agreed that certain trees always produce more rubber than others. But, on the other hand, it must be recognised that yields may fluctuate, and that the occasional heavy yields from individual trees may be due to canker which in the early stages of attack stimulates the latex flow. In order to determine the yield of a tree, the daily production of latex should be noted for a long period: for at least 1 year according to M. MARSDEN.

2) The selection of the trees for seed production is facilitated by a study of the existing correlations, thus:

a) Trees should be chosen which have a smooth bark of a pink shade.

b) As in the case of the *Cinchona*, the highest percentage of alkaloids is found in the bark of trees bearing least seed, so in that of *Hevea*, there is an inverse correlation between latex yield and seed production. Therefore, with the present haphazard system there will be a tendency to select the trees producing most seed (and consequently less latex) which will cause a deterioration in the plantations. On the other hand, scanty seed production is not only found in trees with a heavy latex yield, but also in trees which are attacked by *Phytophthora Faberi*, a cryptogamic pol disease which is very prevalent. When the area intended for seed collection has been chosen, the fungus should be kept in check by continuous spraying, especially in the monsoon season.

3) Seeds should be also selected from trees of good bark-renewing ability; this is due, as is well known, to the activity of the cambium and is chiefly a question of the general health of the tree.

4) When the trees with the best general development and the high-

est yield in the plantation have been determined, the work of selection can then be proceeded with, according to 2 different methods.

a) Individual selection (by pure lines): the seed of each tree having been collected separately it should be sown in an isolated place, protected from cross-fertilisation by a belt of some quick-growing trees, such as *Albizia*. Even if cuttings are used, individual selection is a long process and the results may be negative, as the hybrid, heterozygous parent may produce varied and heterogeneous offspring with a predominance of worthless individuals. Therefore it is better to employ the following method:

b) A small area of the plantation containing trees of known yielding quality and good development should be taken. This should be carefully watched for 2-3 years, the daily latex yield being noted and the unsatisfactory trees eliminated. This would probably leave about 40-50 trees per acre. The thinning out of unproductive trees decreases the risk of cross-pollinisation. Taking a widely planted area — 60 trees per acre — fully 75 per cent of the seeds would be self-fertilised, since an insect, when once it arrives at a tree, stays, and does not give itself an unnecessary amount of flying, by going from one tree to another, even if the distance between them is small. The seed collected from the best trees which remain after the unsatisfactory ones are removed, will stock the nurseries. An excess of trees up to 200 per acre should be planted, in order to leave ample scope for the subsequent work of selection and improvement.

539 - **The Improvement of Lemon Trees by Selection in California, United States.**—

SHAMMEL, A. D., in *The Journal of Heredity*, Vol. VIII, No. 2, pp. 75-81 + 1 Plate. Washington, D. C., February 1917.

Having secured the financial support and the collaboration of many fruit-growers in the principal citrus-growing districts of California, the writer began, in 1909, a systematic study of the bud variations, their extent and frequency, in the 3 chief varieties of lemon: Eureka, Villafranca and Lisbon.

The plan of study pursued was to mark out performance record plots containing from 5 to 100 trees in orchards where the conditions were particularly uniform and favourable for securing reliable data regarding the productivity and other characters of the trees and their progeny. Each tree was distinguished by a letter, or number, and a record was kept of its progeny, so that the offspring of any variation could be readily traced back to the parent, and its development studied from its first appearance. The buds for progeny tests from the select trees are now more than 2 million in number, which gives some idea of the extent and importance of the work.

In each of the 3 above mentioned varieties, there occur several forms differing in: habit of growth — characteristics of bloom — season and amount of production of the fruit — size, shape and colour of the fruit — thickness and appearance of the rind — amount and quality of juice — etc.

The Eureka lemon trees may be preliminarily classified under 2 heads: 1) the productive strain; 2) the shade strain. In the latter, the trees

develop a large percentage of abnormal flowers, the pistils being rudimentary or absent, so that shortly after blooming, these flowers fall, and consequently produce no fruit. The crop produced by the normal flowers ripens mostly during the autumn, while the trees of the productive strain of the Eureka variety have a strong tendency to bear fairly regular monthly crops.

The same thing occurs in the Lisbon variety, but in this case, the shade trees bear most of their crop during the spring months.

The trees of the shade strain are greatly inferior to those of the productive one, not only in yield (which is 5 times less), but also in the quality of their fruit, only 20 per cent of which is of the best grade, as against 80 per cent in the case of the productive strain.

In June 1912, the writer and his associates made a tree census of a lemon orchard containing about 16,000 trees. It was found that 3,200, or 20 per cent, of the trees were of the undesirable shade strain. In another Eureka orchard, which was 20 years old, there were only about 10 per cent of the shade trees. The increase in the number of inferior trees is due to the fact that a larger proportion of the bud wood used for the propagation of the first orchard had been cut from the shade trees rather than from the productive trees.

In addition to the 2 fundamental strains known as the shade and productive strains respectively, other forms may be distinguished which are characterised by anatomical and physiological conditions in direct correlation with productivity. In unsuccessful or unprofitable lemon orchards as many as 60 per cent of the trees have proved to belong to worthless forms.

There is no doubt that the different forms that have been recognised and classified by the assistance of a careful study of genealogical data have been propagated, in many cases unintentionally, by bud sports. In fact, it is not unusual to find on the same tree, branches bearing 3 or 4 different kinds of fruit which can be subsequently propagated by grafting.

Bud variation in the different sorts of lemon trees is much more common than has hitherto been supposed, and the continued study of this phenomenon has led to the discovery of the best means to be adopted by selectors. These are as follows:

- 1) The elimination of unproductive forms, the selector being guided by correlative anatomical data.

- 2) The selection of scions from trees which are not only distinguished by great productivity, but also by uniformity in the character of their offspring.

The tendency to produce variable fruits and foliage is more pronounced in some forms than in others and is transmitted, thus giving rise not only to undesirable varieties, but also to a distinct decrease in the crop.

Instead of creating new varieties, it is advisable to adopt *one* variety from which 3 or 4 strains may be obtained by selection. These strains should only differ in their season of heavy production, and would therefore produce crops during the whole year, thus enabling the growers to

establish a more valuable reputation among consumers, for a standard Californian lemon.

540 - **Experiments with Spring Cereals at the Eastern Oregon Dry-Farming Sub-station, Moro, Oregon.** — STEPHENS, DAVID E., in *U. S. Dept. of Agriculture, Bulletin* No. 498, 37 pp., 16 fig. Washington, February 19, 1917.

The Moro Dry-farming Sub-station in collaboration with farmers, has carried out tests with spring cereals over the five year period 1911-1915. Moro is situated in Sherman County, upon the rolling hills drained by the Columbia River, and about 15 miles from this latter. The elevation of the sub-station is about 2 000 feet. The soil and climatic conditions are typical of a large part of the Columbia Basin in the States of Oregon and Washington.

The average annual precipitation at Moro and neighbourhood for the past 11 years has been 11.35 inches. The average precipitation during the growing season (March to July inclusive) for the 5 year period 1911-1915 has been 3.83 inches. The average annual evaporation from a free water surface in summer, during the 7 months April to October inclusive, has been 45.07 (5-year period). The ratios: evaporation-precipitation, during the growth period, and evaporation-precipitation, for the whole year, are higher at the Moro Sub-Station than at those of Nephi (Utah) and Moccasin (Montana).

The average duration of the period of frosts has been 155.8 days. The average date of the last frost (32° F.) in spring has been May 2; that of the first autumn frost, October 5.

The average wind velocity has been 5.9 miles per hour. The experiments with cereals, executed at Moro, included: selection trials — crop rotation — soil cultivation. The present bulletin contains only the results of the trials of spring cereals.

Wheat. — Seventy-six varieties of spring wheats have been tried over periods of two years or more. During the 5 year period 1911-1915, the highest average yield was given by the variety Early Baart (22.2 bushels per acre). The selection from Koola (C. I. No. 2203-2) gave the highest three-year average yield, 27.7 bushels per acre, in the years 1913, 1914 and 1915.

The average yield of 14 varieties of common and club wheat in 1913, 1914 and 1915 exceeded the average yield of 2 durum varieties by 3.5 bushels per acre. The average yield of the highest yielding common wheat exceeded the average yield of the highest yielding durum wheat by 7.7 bushels per acre in the same period.

Milling and baking tests of several of the spring-wheat varieties grown at the Moro sub station have been made by the Plant Chemistry Laboratory of the Bureau of Chemistry of the United States Department of Agriculture. These tests indicate that most of the varieties are as good and some are better milling wheats than the Pacific Bluestem, which is the standard spring wheat of the Columbia basin.

Date of seeding experiments with Pacific Bluestem spring wheat indicate that seeding as early in the spring as possible gives the best results.

TABLE I. -- *Kernel characters and 3-year average yields of leading varieties of spring wheat grown at the Moro Sub-station in 1913, 1914 and 1915, arranged by classes, with the average yield per acre of each variety and of each class.*

Class and variety	C. I. No.	Character of kernels	Average yield per acre in bushels. 1913 to 1915
COMMON AND CLUB			
<i>Beardless :</i>			
Pacific Bluestem	4067	Soft, white	21.4
Ghirka	1517	Soft, red	20.7
Karum	2200-1	Hard, white	26.3
Little Club	4066	Soft, white	21.6
Marquis	4158	Medium hard, red	22.6
Sonora	3036-2	Soft, white	20.2
			<i>Average</i> 22.1
<i>Bearded :</i>			
Aulicista	2407-2	Hard, red	22.0
Chul	2227-1	do.	21.3
Early Baart	1697	Soft, white	25.9
Heine Squarehead	2669-1	Soft, red	22.0
Koola	2203-2	Medium hard, red	27.7
Tallinka	2495	Hard, amber	25.5
Yantagbay	2404-1	Hard, red	22.0
Zacatecus	2799-2	Soft, red	21.0
			<i>Average</i> 23.7
DURUM			
Black wheat	2511	Hard, amber	20.0
Kutabanka	1510	do.	18.5
			<i>Average</i> 19.3

Rate of seeding experiments with the Pacific Bluestem variety indicate that for early spring seeding about 5 pecks per acre is the best rate. For late seeding 3 pecks per acre produced the highest yields.

Oats. — Of the 20 oat varieties under experiment for a period of at least 2 years, the early varieties, like Kherson and Sixty-Day have given the best results, though Siberian, a variety maturing in mid-season, has given yields practically as high as the Sixty-Day and Kherson in a 5-year average.

Barley. — 42 varieties of spring barley have been tested, and 5-year average yields obtained for 13 varieties. The variety giving the highest average yield in the 5 years was Marion C. I. No. 261, a 6-rowed form, yielding 34.3 bushels per acre. The 2-rowed forms white Smyrna and Haunchen produced average yields, in the same period, of 33 and 22.2 bushels per acre, respectively.

TABLE II. — *Agronomic Data and 3-year average yields for the 11 most important varieties and selections of spring oats tested at the Moro Sub-station from 1913-1915.*

Variety	C. I. No.	Date headed	Date ripe	Height Inches	Bushel weight Pounds	Average yield per acre Bushels
Sixty-Day selection . . .	165-1-1	June 16	July 9	28	30.7	54.9
Kberson	459	" 18	" 13	26	30.0	50.1
Sixty-Day	165	do.	" 12	26	30.7	52.6
Siberian	635	June 27	" 20	34	34.0	49.7
Storm King selection . . .	522-1	do.	" 18	33	33.0	48.3
Canadian	444	June 26	do	33	30.5	46.8
Local variety	795	" 29	July 20	32	28.4	44.6
Swedish Select selection . .	134-1	" 26	" 18	33	32.4	43.5
Shadeland Climax	681	July 1	" 21	32	33.3	42.3
Black American	549	June 28	do	28	28.6	39.9
Swedish Select	134	" 26	July 20	32	32.7	41.6

TABLE III. — *Average yield of 13 spring barley varieties, grown at the Moro Sub-station during the 5-year period, 1911-1915, inclusive.*

Variety	C. I. No.	Average yield per acre in bushels
Black Hull-less	596	24.2
Beldi	190	28.3
Chevalier	200	23.6
Coast	620	29.0
Gatani	575	27.8
Hannchen	531	32.2
Hanna	24	26.5
Mariout	261	34.3
Maban	1144	24.6
Manchuria (Minn. No. 105) . .	576	29.6
Oderbrucker	537	29.4
Svanhals	187	28.5
White Smyrna	658	33.0

TABLE IV. — *Average acre yields of all spring wheat, oat, and barley varieties grown, 1913-1915.*

Crop	Yield per acre	Value per acre
Spring barley	1572	\$ 19.11
Spring oats	1185	10.49
Spring wheat	1206	17.50

Spring emmer has not given as good results as spring barley or oats.

The *grain sorghums* have not given profitable returns. Of the varieties tested, Manchu Kaoliang is the most promising.

The 5 year average yield in pounds of the highest yielding varieties of the three leading cereals was as follows: Wheat, 1362 pounds; oats, 102 pounds; barley, 1646 pounds.

Based on the 10-year average farm price of these cereals in Oregon, the acre value of wheat would be \$ 18.39; oats \$ 19.35 and barley \$ 20.35.

The above tables summarise the principal results.

1. **Studies on Wheat in the Province of Rovigo, Italy.** — BERTONI, G., in *H. Colture Agric.*, Year 63, No. 10, pp. 327-332, 3 fig. Casale Monferrato, April 10, 1917.

A summary of the chief results obtained by Prof. MALANDRA, Director of the travelling Chair of Agriculture of Lendinara, from experiments described in his work "*Le varietà di frumento in Polesine*" ("The varieties of wheat in Polesine"). The work bore on the time of sowing, manuring, date of ripening, resistance to lodging and rust, and the behaviour of the different varieties as regards the various physiological and parasitic diseases.

The varieties most resistant to lodging are: Nonette de Lausanne, Hybride Inversable de Vilmorin, Hybride Trésor, and Gros Bleu.

As regards resistance to rust the best varieties, in decreasing order of resistance, are: Nonette, Cavallasca, Semiduro del Fucino, Gentil rosso, di originario, Inversable, Gros Bleu, Hybride Trésor, No. 12 Family of Colonia Veneta, Rosso Olona.

The early-maturing varieties are (in decreasing order): Colonia Veneta (original and reproduced), No. 12 Family of Colonia Veneta, Gentil Bianco, di. Rosso Olona, Gentil Rosso, Inversable, Gros Bleu, Hybride Trésor, Cavallasca, Semiduro del Fucino, Nonette de Lausanne (ripens 12 to 15 days after the Colonia variety).

2. **Results of Trials in 1916 at the German Station for Potato Growing** etc. — VON ECKENBRECHER, R., in *Zeitschrift für Spiritusindustrie*, Year 1917, Supplementary No. 1, pp. 1-57, Berlin, 1917.

In 1916, on account of the war, the number of experimental fields at the above station has been reduced from 32 to 30, distributed over the same farms and districts of Germany as in 1915. The varieties tested numbered 20. Among those of 1915, the writer has eliminated: Zukunft Geheimrat von Rümker — Attyk — Landrat von Ravenstein — Gerst — the value of which is fairly well known.

To compensate, the following new varieties have been tested: Lotos — Minosa — Hindenburg — Prof. Wohltmann de Cimbal — Astra — Kaiser — Prof. Wohltmann. For the varieties already tested in 1915, the seeds were derived from the 1915 experimental fields.

3. The results of the 1914 trials are summarised in *B.*, 1915, No. 195, and those of the 1915 trials in *B.*, 1916, No. 513.

(Ed.).

TABLE I. — *Classification of the different varieties according to their yield.*

Classification according to yield of tubers				Classification according to starch content			
Varieties	Starch content	Yield of tubers per hectare	Maturity	Varieties	Starch content	Yield of tubers per hectare	Maturity
		quintals				quintals	
1 Hindenburg	17.9%	279.1	semi-late	1 Hindenburg	17.9%	279.1	semi-late
2 Prof. Wohlmann (Grelitz) 19	19.7	247.7	late	2 Prof. Wohlmann (Grelitz) 19	19.7	247.7	late
3 Deddora	18.1	234.3	semi-late	3 Parnassia	18.1	234.3	semi-late
4 Parnassia	19.7	228.4	"	4 Deddora	18.4	234.3	"
5 Lotos	15.3	226.4	"	5 Uruu	18.4	234.3	"
6 Uruu	18.4	218.9	late	6 Wohlmann (C. orig.)	18.2	214.7	late
7 Wohlmann (C. orig.)	18.2	214.7	"	7 Roede Star	18.5	201.1	semi-late
8 Mimosa	14.4	211.6	semi-late	8 Bochems Erfolg	18.4	201.4	semi-late
9 Geelynn	17.7	206.3	semi-late	9 Geelynn	17.7	206.3	"
10 Bochems Erfolg	18.4	201.4	"	10 Lotos	18.5	168.3	"
11 Roede Star	18.5	201.1	late	11 Wohlmann 14	18.4	168.3	late
12 Astra	17	179	"	12 Mimosa	14.4	168.3	semi-early
13 Wohlmann 34	18.4	168.3	"	13 Astra	14.4	168.3	late
14 Prof. von Eckenbrecher	14	165.7	semi-late	14 Wohlmann (C. old)	17.8	156.7	"
15 Wohlmann (C. old)	17.8	156.7	late	15 Prof. Gerlach	17.6	151.4	semi-late
16 Prof. Gerlach	17.6	151.4	semi-late	16 Richers Imperator	17.2	151.3	"
17 Richers Imperator	17.2	151.3	"	17 Präsident von Kitzling	17	149.5	"
18 Präsident von Kitzling	17	149.5	"	18 Excellenz	16.2	146.9	"
19 Excellenz	16.2	146.9	"	19 Prof. von Eckenbrecher	14	165.7	"
20 Dalersche	17.7	166.2	"	20 Dalersche	17.7	166.2	"

The size of the plots, the cultivation, manuring and harvesting were carried out exactly as in 1915.

In 1916, the weather generally was very unfavourable for growing potatoes. The dry weather in May retarded their early growth and made the crop a very irregular one. At the beginning of July the fields looked very well and there was the prospect of a good crop, but the subsequent rains hindered further development, favoured disease (*Phytophthora* particularly attacking early and mid-early varieties) and caused a faulty development of the tubers. Later, thanks to the fine spell in September, the damage was partially repaired, especially in the case of the late varieties, which were remarkable for their high starch content.

Table I classes the different varieties according to their yield of tubers and starch per hectare (1), whilst Table II compares the 1916 yields with those of the preceding years; it shows that: in 1916, the average yield in tubers was 54.5 quintals lower than in 1915; the starch content lower by 0.4 %; the starch yield lower per acre by 11 quintals. 1916 shows the lowest record of all the years in which experiments have been in progress with the exception of 1904 and 1911. The same diminution of yield in 1915 occurred throughout all the experimental fields.

All the varieties cultivated in 1915 showed a decreased yield of tubers in 1916, estimated, on the average, at 84 quintals per hectare and even reaching 107.1 quintals per acre for the Prof. Gerlach variety.

Among the varieties cultivated in 1915 and 1916, ten showed a decrease in the starch content in 1916, in two varieties the starch content had increased and in two others it had remained the same. In 1916, the maximum starch content was 20.8 %, the minimum 14 %.

With regard to the degree of resistance to disease, results are known from 19 experimental plots. The following data show the worst and least attacked varieties:

		Tubers diseased
Worst attacked	Richter's Emperor	6.5 %
	Dabersche	5.8
	Präsident von Klitzing	5.7 %
	Prof. von Eckenbrecher	4.0 %
Least attacked	Parnassia	1.0
	Hindenburg	1.0

Mention is also made of the different diseases (*Phytophthora*, leaf mild, etc.) in the different varieties.

With regard to the keeping qualities (cellar stored) of the 1915 crop, the following list shows comparative values:

Good to very good: Prof. Gerlach — Roode Star — Wohltmann 34 — Prof. Wohltmann — Kolbata.

(1) 1 quintal per hectare = 80 lbs per acre.

Good: Gedymin — Dubersche — Parnassia — Excellenz.

Fairly good to good: Boehm's Erfolg — Ursus — Prof. von Eckenbrecher — Präsident von Klitzing.

Fairly good: Richter's Imperator.

In conclusion, the writer gives notes on the general value of each variety (more especially with regard to those tested for the first time) and their value for human consumption.

TABLE II. — Yields in 1916 compared with those of preceding years or periods.

Years or periods	Average yield of tubers per hectare	Average starch content	Average yield in starch per acre
	quintals		quintals
1888-1892	215.6	19. %	41.2
1893-1897	233	18.9	43.9
1898-1902	251	19	47.4
1903-1907	235.2	18.2	42.8
1908-1912	227.5	18.1	41.2
1913	226.3	17.5	45.7
1914	209.5	18.3	38.7
1915	246.4	17.9	44.4
1916	191.9	17.5	33.4

543 — Sweet Potato Culture in the United States and in Sicily. — I. JONSSON, T. C. and ROSA, J. T., Jr. Sweet Potato Culture, in *Virginia Truck Experiment Station Bulletin* 10, pp. 387-415. Norfolk, Virginia, April, 1, 1916. — II. BORZI, A., The *Batatasch* in Sicily, in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo* Vol. III, Parts 3-5, pp. 118-127. Palermo, 1916.

I. — *Sweet Potato Culture in the United States.* — Sweet potatoes are increasing in value and importance as a commercial truck crop in the United States. The acreage under sweet potatoes increased 12.2 per cent between 1909 and 1915. The total yield in 1915 was 74 295 000 bushels.

The value of the crop can be further increased by the use of modern storage houses, better methods of packing, and closer attention to grading.

Under the conditions obtaining in the United States, the sweet potato seldom flowers or sets seed. It is therefore propagated by cuttings, or by rooted sprouts from the tubers. Therefore it has been found that the only practical basis for the improvement of the sweet potato is the hill unit. By going through the field at harvest time and selecting the best hills, great improvement can be made in the yield and quality of the crop. The characters to be aimed at in selection are: size, shape, colour, and freedom from disease. It is necessary to select every year and for the same characters.

The numerous varieties of sweet potatoes may be divided into 2 general market types: 1) the dry, mealy-fleshed varieties generally preferred on the northern markets; 2) the moist-fleshed, sweet varieties preferred on the southern markets. The varieties best suited for cultivation in East Virginia are: Little Stem Jersey (yellow Jersey or "Up-River"), Big Stem Jersey, Southern Queen (Hayman), Nancy Hall, and Porto Rico. Other good varieties are: Triumph, Georgia, Yellow Yam, White Yam, and Pierson. Heavy yielding varieties valuable for stock food are: Key West Yam, Creola, and Red Brazil.

In Virginia, sweet potatoes are sown on a layer of sand placed upon manure. To prevent the introduction of disease into the hot bed, fresh sand should be used each season. An excellent prophylactic measure consists in treating the seed for 5 or 10 minutes just before bedding with a 0.9 per thousand solution of corrosive sublimate. The same solution may be used 3 or 4 times. The use of formalin for seed disinfection is not advised.

Transplanting tongs facilitate the work of setting. Two-horse transplanting machines are very useful in setting large areas, for they set the plants more evenly, much faster and just as well, or better, than by hand.

On the Eastern Shore of Virginia, the ridges are usually made 28 to 30 inches apart, and the plants are set from 16 to 22 inches apart. When the plants are set as far apart as 22 inches, 2 plants are usually set together in each hill.

Cultivation consists chiefly in keeping down weeds. The drill plough should first be used followed by hand-hoeing. For harvesting large areas, special types of diggers are used. The best method is to cut the vines with a "vine-cutter" and the roots are then thrown out by an ordinary turn plough. During harvest and the subsequent handling of the potatoes are must be taken to avoid bruising the tubers, as when bruised they turn black and rot.

In trucking sections in the United States, sweet potatoes are usually sorted into 2 grades, primes and culls. These grades are based entirely on the size of the potatoes, everything going as primes, except the small and stringy potatoes. Occasionally a third grade is made, "extra fancy", consisting of the most select potatoes, uniformly medium-sized, regular in shape, and free from any injury. When some of the potatoes are very large, a fourth grade "Jumbo" is made. These are much sought after in some markets. The writer advises the adoption of these 4 grades.

For packing, barrels and crates are used, or what is still better, Delaware hampers, which cost no more than barrels, are much more easily handled and prevent the potatoes being bruised. In order to keep potatoes well, they must first be dried out of doors, or in a well-ventilated building at 50-60° C., and then kept at a temperature below 12° C. These conditions can best be attained in a specially constructed modern storage house; small quantities can, however, be kept in outdoor storage pits, where they are piled in a conical heap.

Storage in hampers is more convenient and satisfactory than storage in barrels.

Sweet potatoes are subject to many serious diseases: stem rot (*Fusarium Batatas*) — black rot (*Sphaeronema fimbriatum*) — foot rot (*Plenodomus destruens*) — scurt (*Monilochaetes infuscans*). These, however, can always be prevented by: choosing healthy tubers for planting — immersing the tubers in a 0.9 per thousand solution of corrosive sublimate — disinfecting the seeds — rotation of crops.

The Little Stem Jersey variety, which produces a good dry table potato, is especially adapted for shipping in hampers to northern markets.

II. — *Sweet-Potato-Growing in Sicily.* — The potato was introduced by GASPARRINI into Sicily in 1824 and planted in the Royal Garden of Boecadifalco, near Palermo. It is now cultivated on the north coast of the Province of Messina, the area under the crop increasing every year. The writer is of opinion that potatoes can be grown in south Italy wherever citrus trees flourish and under the same conditions of soil and irrigation.

The potato requires a fairly compact and well-aerated soil; it does very well in the sandy, fairly manured, reclaimed land on the coast. It must be irrigated, but not frequently or liberally. In very light permeable soils like those of San Filippo del Mela, Spadafora, Saponara, etc. (Province of Messina), 2 or 3 irrigations are sufficient per month from May to September. The soil is cultivated to a depth of 35-40 cm. and manured as heavily as possible; then it is cleaned, divided into plots from 1.5 to 2 m. wide by means of trenches which serve for irrigation purposes, and facilitate hoeing and ploughing operations.

The potatoes are propagated by cuttings taken from the erect portions of decumbent stems, 15 to 25 cm. long and bearing 5-10 leaves, (that is to say, by roots which are not yet completely tuberised) which have been kept from the harvest of the preceding autumn, and stored on an open dry spot. They should be placed in a single row and covered with a layer of sand, or ashes, from 5 to 6 cm. deep. The object of this method of preserving the untuberised roots is to promote bud formation which is complete towards the end of April, or early in May.

Growth reaches its highest development in summer. The harvest begins at the end of October, and continues till the end of December.

In Sicily, under good cultural conditions, 500 kg. of tubers are produced per "are". The potatoes, in normal times, sell for from 20 to 25 lire per quintal (= 16 to 20 shillings at par); in 1916, they fetched as much as 30 lire.

According to the writer, the potato should be more extensively grown in southern Italy than it is at present, and should be cultivated as a forage plant also, for not only the tubers, but also the green portions of the plant, form a good food for cattle, if they are cut at the time of harvest.

44 - Influence of the Time of Cutting on the Yield of Lucerne, in Italy. — MORRETTI, A., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, Part II, pp. 541-562, Modena, 1916.

The best time for cutting meadow-land is known to be at the beginning of the flowering period, but it is not always possible to effect it at this time and the majority of farmers prefer to postpone the time of cutting rather than to anticipate it.

In order to ascertain whether this practice is a good one, the writer undertook to study the effect of anticipating or retarding the 1st. and 2nd. cuts upon the yields from subsequent cuts. His researches were carried out in 1914-1915 upon land adjoining the "R. Istituto Superiore agrario sperimentale" at Perugia, situated on a gentle slope and arranged in wide strips, the test plant used being lucerne grown without irrigation.

EXPERIMENTS IN 1914. — 1) A piece of land of 270 square metres was divided into 9 plots of 30 square metres each. The first was cut on April 10, the others in turn at 5 days' interval. On April 25, flowering had not yet begun; on May 1, the first buds had begun to show at the base of the stems. The following cuts were made on each plot at the beginning of flowering and before the appearance of the buds.

On the last two plots it was impossible to make a fourth cut, the growth being too thin. On none of the plots was it possible to effect a fifth cut. The results, summarised in Table I., show that the unit maximum production (74 666 kg. per hectare = 20 640 kg. of hay) was obtained on the 4th. plot.

2) It was wished to investigate the influence exercised by anticipation or delay of the 2nd. cut. For this purpose, another piece of land was utilised, divided into 8 plots of 30 sq. metres each. The first cut was made on May 10; the second on the date given in Table II; the subsequent cuts were made at the beginning of flowering. The total results, given in Table II, show that both for the first and second cuts, the best period is the beginning of flowering and that by anticipating or retarding the cutting in relation to this period, the yield obtained is lower the greater the time of anticipation or postponement.

EXPERIMENTS IN 1915. — Contrary to what was done in the preceding year, the cuts subsequent to the first one were no longer made at the beginning of the flowering on each plot, but according to the anticipation or delay in the cutting of the 1st cut, i. e. the first plots were always cut early, the others always late. With slight variations, the results obtained were similar to those of the preceding year.

Further, in order to gain a better idea of the quality of the forage, the yield of leaves and stems was determined for each plot. It was found that the percentage of stems from the 1st. cut increased from the 1st. plot (58.2 %) to the 7th. (72.2 %) whilst the percentage of leaves, as may be imagined, proceeded in inverse direction.

The same variations were noted for the 2nd. cut but less clearly.

On the other hand, for the 3rd. cut, no variations were noted in a definite direction.

TABLE I. — Influence of the time of the 1st. cut.

Plots	1st. cut			2nd cut			3rd. cut			4th cut			Total yield	
	Date of cut	Yield per plot		Date of cut	Yield per plot		Date of cut	Yield per plot		Date of cut	Yield per plot		grass	hay
		grass	hay		grass	hay		grass	hay		grass	hay		
1	10 IV	63 kg	20.66 %	4 VI	50 kg	23.43 %	27 VII	51 kg	30.33 %	16 IX	15 kg	37.10 %	181 kg	45.15 kg
2	15 "	75	21.86	12 "	56	27.00	27 "	57	27.03	16 "	18	40.00	206	55.18
3	20 "	76	22.53	15 "	51	24.43	30 "	60	27.76	16 "	20	37.16	207	53.05
4	25 "	84	27.13	20 "	60	23.10	1 VIII	59	29.33	18 "	21	37.16	224	61.92
5	1 V	74	28.40	25 "	69	23.53	8 "	56	27.73	18 "	10	39.76	209	58.11
6	5 "	72	20.13	30 "	74	24.93	12 "	55	28.33	5 VIII	9	37.33	210	58.54
7	10 "	66	29.40	6 VIII	77	26.43	17 "	47	32.66	24 "	12	40.00	202	59.61
8	15 "	60	37.00	10 "	72	24.06	22 "	42	32.63	—	—	—	174	52.58
9	22 "	52	33.89	15 "	75	25.66	28 "	41	32.21	—	—	—	168	50.03

* 100 % of weight of grass.

TABLE II. — *Influence of time of 2nd. cut.*

Plots	Time of 2nd. cut	Total production of 2nd, 3rd. and 4th. cuts per plot	
		green	as hay
1.	15 VI	140 kg	36.31 kg
2.	20 "	143	37.67
3.	25 "	138	35.33
4.	30 "	141	37.71
5.	6 VII	132	36.92
6.	10 "	126	37.97
7.	15 "	119	35.06
8.	20 "	80	37.10

If the cuts are delayed, the proportion of stems is thus appreciably increased which tends to render the quality of hay more ordinary, even when the continual progress of lignification is neglected. These results were confirmed by those obtained on another piece of ground.

Summarising the results obtained during the 2 years' experiments it may be concluded that:

1) By advancing or postponing the cuts of lucerne on the normal time which corresponds to the beginning of flowering no increase in the total quantity of forage is obtained.

2) The largest quantity of forage is obtained by making various cuts at the beginning of flowering and before the new buds appear at the base of the plants.

In the localities where the experiments were made the anticipation of the time of cutting lucerne has not increased the production of forage, contrary to the results obtained in other localities (Hohenheim, Proskau, Utah) and by other workers (CAROLA, WOLFF, FOSTER and MERILL). The present writer considers that this is to be attributed to the fact that in the Province of Perugia, the amount of rainfall is insufficient to produce a beneficial effect after the time of the 1st. cut.

If it is impossible to make the cuts at the beginning of flowering, it will be less unfavourable to advance rather than to retard them; in the first case one only loses on the quantity of hay, whereas, in the second case, there is a diminution of the nutritive value also, and this decrease is greater the greater the delay.

545 — **Cotton-growing Trials at the Palermo Royal Colonial Garden, Sicily, in 1915.**

— *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Parts 1-2, pp. 8-17, Palermo, 1916.

In comparison with previous years, the 1915 trials with cotton-growing at the above-mentioned Garden have only given results of moderate

interest; this being on account of the exceptional conditions prevailing in that year. However, the results obtained with the following varieties are still worthy of mention: Boyd's Prolific — Toole — Mitafifi — Caravonica Wool.

The preparation of the ground, manuring, seeding and general care were the same as in the preceding year.

There was a slight variation in the production: Boyd's Prolific, unmatured, yielded 1400 kg. per hectare, or 93 kg. more than the previous year; for the other sorts the increases were rather less: Toole, 1297 kg. — Mitafifi, 1309 kg. — Caravonica Wool, 815 kg. These results were from fields which had received per hectare (except Boyd's Prolific) a manuring composed of: farmyard manure, 2000 kg. — superphosphate, 400 kg. — potassium sulphate, 100 kg.

Attention was concentrated on selection work, and the results of the experiments, if not actually decisive, are nevertheless sufficiently encouraging to merit report. The following were the characters which received most attention:

1) *Development.* — At the last seed harvest preference was given to those derived from plants of medium height, as small plants invariably give small yields, both with regard to number and size of bolls, and tall plants give a late and inferior quality crop.

2) *System of branching.* — Plants were chosen which possessed numerous basal branches and strong growth, obvious signs of higher productivity.

3) *Size of bolls.* — This character is of the greatest importance, because it is not only an invariable sign of strong and healthy growth, in other words perfect acclimatisation, but also means a high yield on ginning.

4) *Ripening of bolls.* — The complete ripening of the bolls influences the quality of the product, not only because the staple becomes longer, but also because it acquires greater tensile strength, which allows it to resist perfectly the strain undergone in ginning. The keeping qualities are also improved because the well matured cotton is drier and so keeps longer.

5) *Dehiscence of bolls.* — The more complete the dehiscence, the easier the removal of the lint, which results in reduced cost.

6) *Relative facility with which lint detaches from bolls.* — This character is important and is taken into account in selection.

7) *Number of chambers in each boll:* This varies from 3-5 and directly influences the weight of the boll itself.

8) *Colour.* — This is a character determining variations in the market price, consequently it is endeavoured to make it as homogenous as possible.

The following are characters which determine the market value of cotton, consequently they are the subject of selection:

Flexibility — lustre — length and diameter — homogeneity — fineness — tensile strength and twisting strain — elasticity — method of insertion — equal density of hair-wall.

The results of this careful and patient work of selection for the varieties tested are summarised as follows:

Results of selection of 4 varieties of cotton

Characters	Boyd's	Toole	Mitaffi	Caravonica
Height of plant	48 cm.	42 cm.	80 cm.	140 cm.
Branching	abundant	moderate	good	abundant
Size of capsules	good	good	very good	very good
Number of capsules	14-15	10-15	20-25	180-200
Maturation	complete	good	good	late
Dehiscence of boll	complete	good	complete	mediocre
Detachment of lint	sufficient	mediocre	easy	very good
Number of chambers	4-5	4	3-5	4
Colour of staple	white	white	brown	white
Flexibility	mediocre	mediocre	very good	very good
Lustre	faint	mediocre	very good	very good
Length	28-29 mm.	26-27 mm.	38-40 mm.	45-48 mm.
Diameter	0.0201 mm.	0.02125 mm.	0.02107 mm.	0.0263 mm.
Homogeneity	very good	fairly good	good	insufficient
Fineness	good	good	good	very good
Breaking strain	very good	fairly good	very good	good
Twisting strain	very good	fairly good	very good	good
Elasticity	uniform	fairly good	remarkable	good
Twisting of fibres	homogeneous	fairly good	homogeneous	fairly good
Density of hair walls	homogeneous	fairly good	good	fairly good

It is easy to understand that such selection work cannot give immediate results; it will lead, however, to the formation of an improved Sicilian variety which will possess the 3 most important fundamental characters: good yield — staple of good quality — good resistance to drought.

The chief aim of the experiment is limited to a search for the varieties of cotton which, in the climate and soil of Sicily, may contribute to the progress of this important crop. With the pedigree method one should be able to separate from the common species a certain number of sub-species or varieties, distinct with regard to their botanical characters, but especially so with regard to their characters of economic importance.

During the next few years demonstrations will be given on the best methods of cultivation and on the varieties best adapted to the environment and market requirements.

The fields started in Catania by the Sicilian Agricultural Society Val di Savoia have already given encouraging results with regard to the extension of cotton growing in the Catanian plain.

516 — **Sea-Island Cotton Improved by Selection in the United States.** — See No. 536 of this Bulletin.

547 — **The False Cotton-Plant *Gomphocarpus fruticosus* in Italy.** — PASQUALE, FORTUNATO, in *Bollettino della Società Orticola Varesina*, Year V, No. 17, pp. 5-6. Varese, May 1917.

This member of the Asclepiadaceae is a shrub and a native of India. It has become acclimatised and occurs wild in Sicily and Sardinia, and also elsewhere, as in Corsica. The writer has seen it in the province of Cosenza and recollects having seen it recorded in the Vesuvius district.

It has been cultivated in the Salento district in order to extract the silky material, but no industry on a large scale has developed therefrom.

The textile material is formed by long, stiff, silky threads which surround the numerous seeds. It has the appearance of real silk but has neither its strength nor wearing qualities; its price is markedly lower.

The cultivation of this plant is capable of acquiring great importance in Southern Italy and Tripolitania, as it grows in all soils, even when arid and barren, and requires no other expenses than those of sowing and harvesting; the latter is carried out in proportion as the fruits (follicles) dehisce. As the plant is distasteful to animals it might be used for making hedges, and in view of its tufted roots, might be employed for fixing shifting soils.

Work preparatory to sowing is limited to the ordinary ploughing made after removal of weeds by a couple of turns with the weeder and another two with the harrow. Sowing is carried at intervals of 1 metre between rows and at a little less distance along the rows. The writer has established, by direct experiment, that the yield of each plant (bush 1 to 2 metres high) is about 100 follicles on the average, yielding about 25 to 30 gr. of vegetable silk. One can estimate 8000 bushes to the hectare (1 ha. = 2.47 acres) giving a crop of 160 to 240 kg., saleable at a price varying at about 2 francs the kilo (the substance is very light). The entire cost of cultivation comes to about 100 francs per hectare (£1, 12s. 1d. per acre).

548 - Relation between Colouration and Maturation in the Sugar Cane in Java. —

SCHELTEMA, A. M. P. A., in *Archief voor de Suikerindustrie in Nederlandsch Indie*, Year 25, Part 7, pp. 189-196. Soerabaja, February 1917.

The colour of the stems of the sugar cane may differ very greatly in the same variety: in fact, these differences are sometimes so great that it is often impossible to use this colouration as a botanical characteristic in describing a given variety.

The author has attempted to establish a correlation between the stage of maturation and the colouration in the variety E K 2. Samples of green, yellow and red stems gave the following average saccharine content respectively:

	Brix Number	Sugar Content
Green stems	16.10	7.88 %
Yellow stems	16.98	9.48
Red stems	16.60	9.62

These results seem to prove that the colour of the cane may give some indication of its degree of ripeness. The green cane is not yet ripe; when it becomes yellow it is already ripe, and it turns red in those places to which the light has easy access.

The author proposes to carry out similar researches on other varieties of sugar cane.

49 - Experiments on the Manuring of Tea-Plants in Java. — BERNARD, CH. and DEUSS, J. J. B., in *Mededeelingen van het Proefstation voor Thee*. Batavia, 1916.

The difficulty of obtaining exact data as to the effect of any given manure on tea plantations is pointed out. This difficulty is particularly evident during the harvest, which is carried out by women who pick the young leaves. Very minute instructions as to the method of picking are given; nevertheless, some of the women gather the very young leaves, whereas others mix more or less old leaves. As the experimental plots are not always harvested by the same workers, there is a fairly large error in the results. For other reasons as well, the results of the experiments are only a relative value. Tests carried out under the conditions described above, however, give valuable data on the question of manuring tea plants, especially if the results are applied locally and general conclusions are not drawn.

In an experimental field, peanut cake + bone meal gave more satisfactory results than cake + superphosphate. This last manure seems to lose its activity more rapidly. Complete manure did not give such good results, probably on account of the detrimental action of the mixture of a natural manure, such as cake, with a chemical manure, such as potassium nitrate.

The Table given below shows the extra yield obtained with the manures.

	Manure	Increased Yield percentage
Fairly old plantation	Peanut cake	11.50
	Idem + bone meal	14.00
	Idem + superphosphate	7.03
	Other fertilisers	up to 5.50
Younger plantation	Phospho-nitrogenous fertiliser	15.00
	Phospho-potassic fertiliser	27.70
	Complete chemical fertiliser	34.40

In another experimental field, a fertilising mixture frequently used in the tea plantations of Ceylon gave an increased yield of 3.8%. The yield must, however, be controlled for at least one year before definite results can be obtained. Moreover, no conclusive results were obtained from some of the fields which were ravaged by the insect: *Helopeltis Antonii*.

The results of manuring experiments in a large tea plantation are given. There was a marked increase in yield, but a decrease in the quality of the leaves. Attempts were made to render the plants more resistant to the attacks of insects. With this end in view each plant was treated every two years with a manure composed of: 50 gr. peanut cake, 3 gr. double superphosphate and 2 gr. potassium sulphate. The results were satisfactory.

550 - The Cultivation of Aromatic Plants on the Southern Crimean Coast, Russia.

Вульфъ Е. В. (Vouly, E. V.), Пигулевскій Г. В. (Pigulevskii, G. V.) and Альбрехтъ Э. А. (Albrecht, E. A.), in *Ботаническій Кабинетъ и Ботаническій Сады Императорскаго Никитскаго Сада (Botanical Laboratory and Garden of the Nikitskii Imperial Garden)*, No. 3, pp. 41. Ialta, 1916.

In view of the favourable soil and climatic conditions of the southern Crimean coast the propitiousness of the present time for increasing the cultivation of aromatic plants there, and the lack of information on this subject, the Nikitskii Botanical Garden undertook a series of experiment in order to obtain exact data with regard to the cultivation of such plants.

MR. VOULF investigated the yield in essential oils of the following plants: - *Rosmarinus officinalis* L., *Laurus nobilis*, L., *Salvia grandiflora* Ettling, *Lavandula spica* D. C., garden plants; *Hyssopus officinalis* L., a wild plant of the south coast of the Crimea. As suitable apparatus was not available, the distillation of the plants was carried out in a primitive manner by the use of 2 flasks, in one of which was produced the steam necessary to carry the essential oils contained in the plants over into the other flask. The liquid was condensed and the essential oils separate from the water by means of a separating funnel. The appended table gives a summary of the results obtained.

Results of Distillation Experiments.

Plantes distilled	Time at which the plants were picked	Weight of material used for distillation	Yield in essential oil	
			volume	percentage of material used
<i>Rosmarinus officinalis</i> L.	6 a. m.	1 360 gr.	10.3 cc.	0.76
	between 7 and 10 a. m.	1 970	15.0	0.76
	3 p. m.	2 450	21.4	0.87
		5 780 gr.	46.7 cc.	Average 0.80
<i>Laurus nobilis</i> L.	between 5 and 6 a. m.	1 920 gr.	11.0 cc.	0.57
	between 7 and 9 a. m.	3 920	22.3	0.57
	between 3 and 4 p. m.	● 370	6.7	0.4
		7 210 gr.	40.0 cc.	Average 0.53
<i>Hyssopus officinalis</i> L.	between 4 and 6 a. m.	7 200 gr.	20.2 cc.	0.28
	between 7 and 10 a. m.	4 800	15.2	0.31
	between 1 and 4 p. m.	6 490	17.7	0.27
		18 490 gr.	53.1 cc.	Average 0.28
<i>Lavandula Spica</i> D. C.	between 5 and 6 a. m.	2 900 gr.	27.6 cc.	0.95
	7 a. m.	930	10.1	1.09
	between 2 and 4 p. m.	1 850	22.7	1.2
		4 780 gr.	60.4 cc.	Average 1.08
<i>Salvia grandiflora</i> Ettling	1 a. m.	1 540 gr.	9.2 cc.	0.6
	between 7 and 10 a. m.	1 570	5.0	0.3
	between noon and 4 p. m.	1 990	10.0	0.5
		5 100 gr.	24.2 cc.	Average 0.46

Considering that the normal content in essential oils is 1.4 to 2 % for *Rosmarinus officinalis*, 0.4 % for *Hyssopus officinalis* and 0.8 % for *Lavandula spica*, it is considered probable that better results would be obtained if the cultivation of these plants were improved, more especially as the estimations were carried out by a primitive method and that the actual yield in essential oils of the plants studied is probably superior to that found.

MR. PIGOLEWSKII determined the chemical composition of the essential oils obtained by MR. VOULF. They were found to differ little from oils of foreign origin, though they showed some peculiar characteristics. Further research on this subject should be carried out.

The methods for cultivating the plants studied are described by MR. ALBRECHT.

551 - **Tobacco Growing in Russia** (1). -- *Статистика производства, подлежащего акцизам* (Statistics of products subject to indirect taxation), No. 11, Part 1, pp. 1-25; Part 2, pp. 1-5. Petrograd, 1916.

In Russia, superior kinds of tobacco from Turkish and American seed (the *Nicotiana tabacum* variety), inferior kinds (*N. rustica*), called "makhorta", "bakun", "chvizent", and other tobaccos of local origin are cultivated simultaneously.

Table I shows the state of tobacco-growing in Russia for the ten years 1905-1914.

TABLE I. — Tobacco growing in Russia during the years 1905-1914.

Year	Plantations						Production in quintals (2)				
	Number			Area in hectares (1)			Average area of a plantation in hectares (1)	Best tobaccos	Ordinary tobaccos	Total	Per hect.
	Best tobacco	Ordinary tobacco	Total	Best tobacco	Ordinary tobacco	Total					
1905.....	—	—	439 493	—	—	76 830	0.17 ha	423 774	547 110	970 884	12.64
1906.....	—	—	396 977	—	—	58 485	0.14	276 055	458 831	734 886	12.64
1907.....	—	—	377 469	—	—	66 446	0.17	306 376	719 881	1 026 257	15.43
1908.....	—	—	341 966	—	—	68 821	0.20	329 209	614 000	943 209	14.30
1909.....	45 770	292 778	338 548	35 999	29 811	65 801	0.20	342 324	598 485	940 812	15.60
1910.....	43 623	263 671	307 294	42 435	30 565	73 000	0.24	426 386	458 114	884 500	12.12
1911.....	46 200	319 434	365 634	37 592	43 533	81 035	0.22	397 735	866 298	1 264 033	15.60
1912.....	39 385	278 219	317 604	31 272	40 610	71 882	0.23	300 731	946 670	1 247 401	16.80
1913.....	35 107	260 307	295 499	29 411	32 993	62 406	0.21	301 113	757 772	1 058 885	16.96
1914.....	43 023	238 397	281 397	43 227	31 438	74 665	0.26	419 530	600 173	1 019 703	13.66

(1) 1 hect. = 2.471 acres.

(2) 1 quintal = 220 lbs.

(1) See also B., April, 1917, No. 314.

(Ed.)

TABLE II. — Tobacco growing in Russia during the year 1914.

District	Number of towns and districts where the tobacco is grown	Number of plantations	Total area in hectares	Production in quintals			Average production in quintals per hectare (1)
				Best tobacco	Ordinary tobacco	Total	
Eastern	53	6 724	1 808	8 572	4 426	12 998	7.1
Central industrial . .	4	17	3	—	—	31	10.3
Central agricultural .	1 102	57 269	13 034	1 010	264 579	265 589	20.3
Little Russia	1 600	89 090	17 180	15 820	307 721	323 541	18.8
North Western	1	12	0.5	5	—	5	10
South Western	2 688	68 105	360	594	3 207	3 801	10.5
Southern	549	17 720	23 217	255 564	179	255 744	11.0
Transcaucasian	994	22 653	18 175	137 236	3 697	140 933	7.7
Eastern Siberia	151	7 040	164	41	5 935	5 976	39.4
Western Siberia	114	3 858	359	8 035	—	8 035	22.3
Amour	190	7 700	276	2 304	—	2 304	8.3
Turkestan	3	9	82	4 426	54	4 480	5.4

(1) 1 quintal per hectare = 0.796 cwt. per acre.

The number of plantations varied during the last 10 years and shows a tendency to decrease; in 1905 they numbered 439 403; in 1914, 28139 — a decrease of 158 006, or 36 %; in 1914, they numbered 14 012, about 5 % less than in 1913. The area under tobacco during these last 10 years has also decreased, but only by 3 %, that is to say from 76 830 to 74 666 hectares. In 1914 there was a great increase in the area as compared with that of 1913, i. e. 12 249 hectares, or 20 %.

During the last 6 years the plantations and area on which tobacco is grown may be divided into 2 categories, superior and inferior.

Table I shows that the superior tobaccos are grown only in the minority of the plantations ($\frac{1}{3}$ to $\frac{1}{2}$). The area given up to the best tobacco in 1909, 1910 and 1914 exceeded that given up to ordinary tobaccos, whereas the position was reversed in 1911, 1912 and 1913.

The average area of the plantations increased almost continuously from 1905, and in 1910 was 0.24 hectare. During the following years, including 1913, it decreased to 0.21 hectare, or about 14 %. In 1914, the average area of the plantations exceeded that of 1913 by 0.055 hectare.

In Russia ordinary tobaccos are mostly grown. In 1914 their production decreased, as compared with that of 1913, by about 21 %, whereas that of the best tobaccos increased by 39 %.

On the whole, the 1914 harvest was inferior to that of 1913 by 4 %. The unit production of tobacco varied during the ten-year period 1905 to 1914

in 1913 it reached its maximum value, in 1914 it decreased to 14.9 quintals per hectare, or about 12 % less than the preceding year.

The present state of tobacco growing in Russia is shown in Table II, which refers to 1914. In this table, Russia has been divided into the following districts:

- 1) Eastern district (Samara province)
- 2) Central industrial district (provinces of Nijni-Novgorod and Smolensk)
- 3) Central agricultural district (provinces of Voroneje, Koursk, Orel, Penza, Riazan, Saratov, Simbirsk, Zambov and Toula) and Little Russia (provinces of Poltava, Kharkov and Tchernigov)
- 4) North-western district (Grodno province)
- 5) South-western district (provinces of Volhynie, Kiev and Podolia)
- 6) Southern district.

From Table II it may be seen that the best tobaccos are cultivated chiefly in the transcaucasian and southern districts, whereas ordinary tobaccos are grown in Little Russia and the central agricultural districts.

352 **Experiments on the Spacing of Tobacco Plants, in Java.** — DE VRIES, O. and SIBENIUS, E., in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXVII. Semarang, 1916.

This paper contains a detailed description of experiments carried out since 1912 at the Tobacco Experimental Station in Java in order to solve the following problems:

- 1) How is the yield, per plant and per surface unit, affected by the spacing of plants in different soils and climates?
- 2) What effect has the spacing of the plants on the size of the leaves and on their quality and colour?

The following conclusions were drawn from the results obtained:

Yield is perceptibly diminished by close spacing, both in fertile soils and in those less fertile than the average. A spacing of 3 × 1.5 feet is considered best suited to tobacco plantations under the normal soil and climatic conditions of Central Java. With this spacing the size of the leaves, all other conditions being equal, is relatively larger than with closer spacing.

So far as the quality of the leaves is concerned, decreased spacing makes them lighter and more uniform. All the experiments showed a marked improvement on this point.

353 **The Relation between the Proportion of Veins and of Fruit to the Leaves in Different Varieties of Mulberry.** — See No. 373 of this Bulletin.

354 **Experiments on the Pollination of Fruit Trees.** — CORRIE, LESLIE GORDON, in *The Journal of Heredity*, Vol. VII, No. 8, pp. 365-369, 1 fig. Washington, D. C., 1916.

Experiments have been carried out chiefly on pot trees at the John Innes Horticultural Institution, Surrey, England, to determine which varieties of the different fruit trees are self-fertile and which self-sterile. The trees were grown in a house where they were strictly isolated from insects. Some of the commoner plums, cherries and apples can be classified as follows:

		PLUMS.	
<i>Self fertile</i>		<i>Self-sterile</i>	
Denniston's Superb		Coe's Golden Drop	
Early Mirabelle		Coe's Violet	
Reine Claude Violette		Wyedale	
Myrobalan (red)		Grand Duke	
La Frune Géante		Jefferson	
Monarch		Reine Claude d'Althan	
Early Transparent		Pond's Seedling	
Reine Claude Bavay		Washington	
Prince Englebert		Early Greengage	
Early Favourite		Old Greengage	
Gisborne's		Ickworth Imperatrice	
Oullin's Golden Gage		Late Transparent	
Golden Transparent		Curlew	
Victoria		Prune d'Agen	
Czar		River's Early Prolific	
Pershire		Stint	
Magnum Bonum (red)		Medlard	
Magnum Bonum (white)			
Kentish			
Warwickshire Drooper			
Damson var's			
		CHERRIES.	
<i>Self-Fertile</i>		<i>Self-Sterile</i>	
Morello		Black Heart	
Late Duke		White Heart	
		Elton	
		Kentish	
		Big Frogmore Early	
		Big Gaboulay	
		Early Rivers	
		Guigne d'Annonay	
		Black Tartarian	
		APPLES.	
<i>Self-Fertile</i>		<i>Self-Sterile</i>	
Stirling Castle		Northern Greening	
Baldwin		Lord Hindlip	
Washington		Cox's Orange Pippin	
		Bramley's Seedling	
<i>Parthenocarpic:</i>			
Lord Derby			
Duchess of Oldenburg			

On the whole the self-fertile varieties correspond with the best croppers; this, however, though general, is not always the case, for River's Early Prolific, which is usually a great cropper, is from a practical view self-sterile, setting only about 1 % of its flowers when self-pollinated. The Duke cherry behaves in a similar manner. Some varieties of plums are probably better pollenisers for certain varieties than others, so care should be exercised in selecting the variety best adapted. For instance, when Old Greengage and the Early Greengage are crossed together only about

% of their flowers develop; whereas, by crossing Greengage with Victoria, excellent results are obtained.

Coe's Violet, Coe's Golden Drop and Jefferson crossed among themselves produce no fruit; crossed with others varieties they produce well.

These phenomena are still more frequent in the apple: Cox's Orange gives good crops when fertilised by pollen from Stirling Castle, Beauty of Bath and Duchess Favourite. Similar facts are observed among cherry trees.

From almost complete incompatibility there occur gradually increasing degrees of affinity with correspondingly greater crops.

The study of this affinity or physiological classification of varieties could be capable of serving as a guide to the choice of the most suitable varieties.

The Walnut Tree and the Pecan Nut Tree. — TRANUT, L., in *Le Progrès agricole et viticole*, Year 34, No. 13, pp. 297-303, 6 fig. Montpellier, April 1, 1917.

In the last few years the value of walnut wood has increased from 30.0 or £ 4.10.0 per cubic yard to £ 9.0.0 or £ 10.10.0. As a result of this rise in price many owners of walnuts have felled their trees in large numbers, so that, in certain districts, there is a considerable decrease. Nevertheless, under suitable conditions, the walnut tree is a profitable investment, even from a point of view of its fruit only. Strong measures should be taken in the different countries to protect these trees, and Switzerland has already shown the way in this respect.

The author proposes that, in the south of France and similar districts, attempts should be made to grow an American tree of the *Juglans* species whose value, during the last few years, has become equal to that of the walnut. This is the pecan nut tree (*Hicoria pecan* Brit = *Carya olivacea* Nutt = *Carya pecan* Engler and Graeb.). This tree grows wild in the following North American States: — Texas, Oklahoma, Louisiana, Mississippi, Alabama, Arkansas, Missouri, Kansas, Tennessee, Kentucky, Illinois, Nebraska and Iowa. It has recently been much cultivated in Florida, Virginia, Georgia, Carolina and on the Pacific coast in California and Oregon, and even in the more northern states, Ohio, Michigan, New York, Pennsylvania, Maryland, Delaware and New Jersey.

A century has not yet passed since the Americans began to gather pecan nuts, to distinguish between the better and the worse varieties and to graft. It is especially since 1900 that pecan nut plantations have increased. In America these trees suffer from certain fungous diseases and from the attacks of insects which do not exist in Europe, a fact which hinders their introduction.

The pecan nut tree is distributed over a very large area, and grows in soils and climates differing greatly one from the other. It grows best in the alluvium of the Mississippi, where it attains a height of 130 feet and a circumference of 10 ½ feet. Its wood is much in demand, and, from 1905 to 1910, the price rose from 2d. to 7d. per pound.

The pecan nut tree was introduced into Europe a century and a half ago, but has not been propagated. Some isolated pecans are almost sterile;

they are not dioecious, but are incapable of self-fertilisation. It is only since the last 15 years or so that the Botanical Department has introduced into France the principal large fruit American varieties and cultivated them. The results have been decisive, and the author does not hesitate to recommend the growing of the pecan nut on the same ground as the growing of the walnut, which it should replace in southern countries where the walnut suffers from the summer heat.

Although it prefers deep, permeable, fertile soils, where its deep root may be in touch with the water-bearing stratum, the pecan nut appears to adapt itself easily to various soils and climates. It may be sown on the spot, but is best grown in a nursery. Seeds should be taken as much as possible from vigorous trees which are known to be acclimatised. The nuts should be laid out in layers, or, two days before sowing, placed in a shallow vessel full of water and exposed to the sun. The soil should be light, and sandy rather than loamy. During the first year the young plants develop roots 4 or 5 times as long as the stem.

Grafting is now general in all American nurseries. All the different methods of grafting have been adopted successfully, but shield budding is most used as it is the easiest. Dull, rainy days are best for grafting. Under favourable conditions trees sown in February or March may give suitable subjects for grafting in the following spring. These trees must be transplanted the following year. The nursery can then supply subjects of from 3 to 4 years for planting out; older subjects are difficult to transplant. Planting is usually carried out in January or February. Great precautions must be taken that the roots, which should be 2 inches long, do not dry up during transport. The subjects should be left in water for a night before being planted. The hole should be deep (6 ft.) The lower part may be filled with fertiliser, covered with good soil, on the top of which the young tree is placed. Care should be taken that the tree be not planted at a greater depth than it occupies in the nursery. It should be watered before the hole is filled up. It is advisable to fertilise the plantation with green manure. From 8 to 10 years are required before any harvest is obtained.

When ripe the husk opens out into four and the nut falls, or is easily picked. The harvest is gathered in the same way as that of walnuts. The nuts should be placed for about 10 days in shallow layers in a well-ventilated loft, and dried; they are then ready for delivery.

It is necessary to clean nuts that fall and lie on the ground. This is done by means of a cylinder in which they are revolved and polished. Before selling, the fruit should also be sorted as the larger nuts always command a higher price.

The pecan nut greatly resembles the walnut. It is more oily, has more delicate taste, and does not turn rancid when kept. Its thin shell is very fragile, especially in the improved varieties.

The high prices obtained by pecan nuts have encouraged horticulturists to cultivate them, and, at present, there are over 100 varieties grown in different climates. The most interesting of these are: Cordier, Curti

rotscher, Indiana, Major, Mammoth, Mantura, Money Maker, Moore, Schley, Sovereign, Stuart, Succès, and van Demen. Many hybrids have been obtained by crossing *Carya olivaeformis* Nutt. with the species *Carya aquatica* Nutt. and *C. laciniosa* Loud. (= *C. sulcata* Nutt.).

56 - **The Formation of National Parks in Spain.** — I. Ley creando los Parques Nacionales, in the *Revista de Montes*, Year XLI, No. 959, p. 27. Madrid, January 1, 1917. — II. Los Parques Nacionales, in *España Forestal*, Year III, No. 22, pp. 29-31. Madrid, February 1917.

Under date December 8, 1916, the King of Spain has sanctioned the following law concerning the formation of National Parks (1):

Art. 1. — National Parks are formed in Spain.

Art. 2. — Under this law all those districts of the national territory shall be known as National Parks which are exceptionally picturesque, wooded or wild, and which are declared to be so by the State for the sole purpose of: facilitating access to them by suitable roads of communication; causing the natural beauty of the landscape, the wealth of flora and fauna, and geographical and hydrological peculiarities to be respected by protecting them in the most efficacious manner possible against all acts of destruction, deterioration or disfiguration due to the hand of man.

Art. 3. — The Minister of "Fomento" is entrusted with: — 1) the formation of National Parks in agreement with the landowners of the districts in which they are situated; 2) the ordering thereof; 3) the allocation of the necessary grants for the formation and maintenance of the roads of communication.

Later, by the Royal Decree of February 23rd, 1917, the Minister of "Fomento" invited the chief Engineers of the forest districts to present to the Board of Agriculture, Mines and Forests, within 2 months:

1) A report on the most noteworthy sites of their circuit which, by reason of their natural or forest beauty, their wealth of flora and fauna, their geographical and hydrological peculiarities are worthy of special protection (account should also be taken of any circumstances concerning religion, history or legend), so that the advisability of declaring them to be National Parks or National Sites may be considered.

2) A report on the natural peculiarities and curiosities which, independently of the surrounding sites, appear, in themselves, to be worthy of special protection.

3) A report on the most remarkable trees, with special reference to those which, by reason of their size, age, rareness, or the traditions attached to them, have become objects of public veneration.

The same Decree also makes the provisions necessary for the formation of a Central Board of National Parks ("Junta Central de Parques Nacionales"), composed of:

1 President (the Director of Agriculture), 1 Vice-President (the Councillor appointed by the Government to the post of General Commissioner of National Parks), 2 Senators, 2 Deputies, 1 Professor of Natural Sciences of the Central University, 1 Inspector or Chief Engineer of Forests, and *per se* the Royal Commissioner of Touring.

(1) See: "Un nuevo servicio forestal" and "Discusión del proyecto de ley sobre Parques Nacionales", in the *Revista de Montes*, Year XLI, No. 959, pp. 1-3, 19-25. Madrid, 1917. — "Parques Nacionales", in *Iberica*, Year VII, No. 173, p. 258. Madrid, 1917. (Ed.)

- 557 - **The Native Trees of São Paulo, Brazil.** — NAVARRO DE ANDRADE, E. (Chief of the State Forestry Service and of the "Companhia Paulista de Estradas de Ferro") and VECCHI, O. (Assistant of the Forestry Service of the above-mentioned "Companhia"), *The native woods of São Paulo; Contribution to the study of the forest flora of the State of S. Paulo, Brazil*, v + 376 pp. + figs. S. Paulo, 1916.

The following details of 157 native trees of the State of San Paulo are given: botanical classification (family and species), common names, distribution, distinctive characteristics of the plant and the wood, specific weight of the wood, products and their use. Figures of the plants or their parts are given.

There are also included figures of parts of 66 other trees which are as yet unidentified.

An appendix gives tables of the specific weight, the resistance to breaking, and flexibility of the woods of many of the trees described.

A bibliography of 10 works is included.

- 558 - **The Forests of Porto Rico, Past, Present and Future.** — MURPHY, I. S., in *United States Department of Agriculture, Bulletin No. 351* (Contribution from the Forest Service) 99 pp. + 7 fig. + XII Plates + 1 Map. Washington D. C., 1916.

The island of Porto Rico is very sparsely wooded. The insular and geographical position of the country, its small size, its restricted area of level lands, and its density of population, have occasioned unusual demands on the forests. The same cycle of change is found here as is recorded by civilisation everywhere — the waste and despoliation of the bounties of nature, followed by an acute need for what has been destroyed.

Of the once extensive virgin tropical forest there now remain only isolated remnants in the most mountainous and wind-swept parts of the island. This tract has an aggregate acreage of between 35 000 and 40 000 acres and includes several thousand acres of brushwood. The total area of high forest is scarcely 2 per cent. of the total land area. Part of these forests belongs to the Government. There are, besides, about 400 000 acres classified as "timber and brush lands" and a few thousand acres of mangrove swamps. The total wooded area amounts to approximately 20 per cent. of the total area of the country; but not more than $\frac{2}{3}$ of this area is now under forest capable of yielding a wood-product other than charcoal and fuel wood. If now there be added the 168 000 acres in coffee plantations and the 6 500 acres under coconut palms, the total of all lands under forest or brush cover will amount to 27 per cent. of the island.

The following forest formations may be distinguished: the littoral woodlands, presenting 2 types, the mangrove swamps and the dry tidal woodlands — the moist, deciduous forests — the tropical rain forests — the dry, deciduous forests — the old field growth — the plantations of coconut, coffee and cacao. In Porto Rico, the climate and hydrological effects of the forests are not very noticeable. The production of lumber and timber is very limited and much must be imported, especially from the United States. The principal forest industry in Porto Rico is charcoal burning. *Bixa Orellana* is grown and supplies a colouring matter;

other colouring and dyeing materials, gums, resins, fibres and fruits produced in the forests would be of decided commercial value if systematically provided.

Reforestation is necessary for the regulation of the water supply and also to provide timber and especially wood for fuel; but in addition, there is great need for scientific knowledge regarding the forestry conditions of the country, systematic management of the existing forest, and improved popular education. Thus an efficient and well-equipped forest administration is required and an energetic forest policy.

The ancient Spanish laws dealing with tree-planting should be enforced and the Board of Commission of Agriculture should have its designation and powers extended to include the subject of forestry. There is in the Sierra de Luquillo, a Forest Reserve (now National Forest which originally formed part of the Spanish Crown lands and after became the property of the Federal Government of the United States. Originally it occupied some 40 000 acres, but is now reduced to 15 000 acres.

An appendix drawn up by Mr. W. D. BRUSH with the assistance of the writer and Mr. C. D. MELL, gives a description of the forest trees of Porto Rico, divided into 172 genera and 57 families.

A second appendix contains a bibliographical index of 100 publications.

559 - **The Forests of the Hawaiian Islands.** — MACCAUGHEY, V., in *The Plant World*, Vol. 20, No. 6, pp. 162-166, 2 fig. Baltimore, Md., June 1916.

The flora of the Hawaiian Islands is noted for its endemic character, which is especially noticeable in the forests. The latter present different types which are dependent upon 2 fundamental factors; elevation and the trade winds. Utilising these two basic factors, the following well-defined types may be distinguished.

- I *Littoral forests*: a) humid (windward); b) arid (leeward).
- II *Lowland forests* (altitude 1 000 to 1 500 ft.): a) humid (windward); b) arid (leeward).
- III *Lower Forest Zone* (1 000 to 2 000 ft.): a) humid; b) arid.
- IV *Middle Forest Zone* (1 500 to 5 000 ft.): a) humid; b) arid.
- V *Upper Forest Zone* (5 000 to 10 000 ft.).
- VI *Boq Zone Forests* (peaks rising into the cloud belt).

Each of these zones and sections is inhabited by representative trees and shrubs which in many instances occur in no other region. Thus *Caesophyllum Inophyllum* Linn. (the "kamani") is distinctive of the humid littoral; *Santalum Freycinetianum* Gaud. var. *littorale* Hillb. ("beach sandwood") of the arid littoral; *Hibiscus tiliaceus* Linn. ("haui") of the humid lowlands; *Erythrina monosperma* Gaud. ("wili-wili") of the arid lowlands; *Alseodaphne moluccana* (L.) Willd. ("kukui") of the lower forest; *Metrosideros polymorpha* Gaud. ("lehua ohia"); and *Acacia Koa* Gray ("koa") of the middle forest; and *Sophora chrysophylla* Seem ("mamani") of the upper forest.

From the point of view of lumber supply, the only forests of value are those of *Metrosideros polymorpha* and *Acacia Koa*. *Metrosideros polymorpha* attains a height of 75 to 100 ft., the wood is dark red, close grained,

hard and very durable. It is chiefly used for flooring, railroad ties, paving blocks and other purposes that require hardness and durability, and is for many purposes superior to the best oak.

Acacia Koa, or "Hawaiian mahogany" is a beautiful golden-red wood prized for fine cabinet work, furniture and interior finishing.

Aleurites moluccana is a conspicuous and abundant tree in the lower forests, but its wood is of little value. The nuts (candle nuts) yield an excellent "wood oil" (1), but the expense of gathering the crop has retarded commercial exploitation, *Prosopis juliflora* ("mesquite" or "kiawe") has been introduced into the lowlands; its pods are used as a cattle feed and its wood for fuel.

The chief value, however, of the native forest is as a watershed, protecting the steep mountain slopes and ridges from erosion by the torrential rains and conserving the water supply. Large areas are now included in the Government forest reserves, under the control of the territorial Bureau of Agriculture and Forestry of Hawaii. These reserves are being enlarged from year to year. The fencing of reserves to keep out cattle, the enforcement of trespass laws, the extermination of the highly destructive wild goats and cattle, are prominent features in the preservation of the forests of Hawaii. These native forests are unusually susceptible to injury and deterioration and there are few places in the world where the imperative necessity of forest conservation is as strikingly demonstrated as in the wooded mountains of the Hawaiian Islands.

LIVE STOCK AND BREEDING.

560 - **The Treatment of Overworked Horses and the Value of the Use of Glucose Serum in Intratracheal Injections.** --- MASOTTO, LEOPOLDO, in *Il Nuovo Ercolano, Rivista di Medicina Veterinaria*, Year XXII, No. 7, pp. 107-113; No. 8, pp. 125-130. Turin, April 15 and 30, 1917.

The value of intratracheal injections of glucose serum on overworked horses was compared with that of a specially good ration, including green fodder, given to army horses of the same age and breed, and with characteristics as similar as possible. The horses of Group I were given a daily ration of 11 lbs. of oats and 11 lbs. of hay, fed at 3 different times, and every other day they were given an intratracheal injection of 1 500 gr. of a 1% glucose serum. The horses of group II received a daily ration of 5 lbs. of oats (cooked during the first week), 15 lbs. of hay, 4 lbs. of dried sugar beet pulp, 3 lbs. of cake. This ration was fed in 5 lots per day.

The treatment lasted 30 days, and the results are summarised in the appended table.

(1) Common "wood oil" which has many technical uses, is the oil obtained from the decorticated nuts of *Aleurites cordata* Steud., grown chiefly in China and Japan. (Ed.)

Comparison between the glucose serum treatment and the special ration for overworked horses.

Breed	Weight at the beginning of the experiment lbs.	Weight after 15 days lbs.	Weight after 30 days lbs.	Increase in weight lbs.	State of nutrition
<i>Horses subjected to special ration.</i>					
Italian	702	720	748	46	} good
American	706	780	802	36	
Norman	744	764	794	50	
Breton	980	982	1016	56	
<i>Horses subjected to glucose serum injection.</i>					
Italian	682	706	722	40	} medium
American	784	802	814	30	
Norman	754	778	794	40	
Breton	998	1026	1044	46	

The results show that, as a general rule, from a practical and economical point of view, good rations are better for recuperative treatment than intratracheal injections of glucose serum, more especially so, as this requires the services of an expert, much time and a certain expenditure. Injections are not recommended in cases of complete prostration and loss of appetite. In other cases the sugar should be administered through the gastric tube, or, still better, both treatments should be carried out in conjunction. By this method two or three intratracheal injections should be given at the beginning. These reanimate the exhausted animal by exciting its appetite. It should then be given a recuperative ration rich in carbohydrates and, if possible, green fodder, so distributed as to give the necessary time for the utilisation of the maximum of the nutritive elements contained in the ration.

561 - **Treatment of Lymphangitis in Horses by Bacteriotherapy.** -- TROCHE, C., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 164, 1st. Half-Year, No. 12, pp. 497-499, Paris, March 19, 1917.

Owing to the serious trouble that lymphangitis threatened to cause among cavalry horses in France, a thorough study was made of this type of disease and important results obtained.

Two chief forms of lymphangitis are known at the present day: *epizootic lymphangitis* and *ulcerative lymphangitis*. The former, introduced into France by horses from North Africa, is almost a novelty to veterinary surgeons. The latter is well known and attacks all domestic animals;

the work of PREISZ and of NOCARD who discovered the bacillus simultaneously, is well known.

The PREISZ-NOCARD bacillus is morphologically similar to that of diphtheria. It produces a toxin, gives a film in MARTIN's broth and its favourite medium is coagulated serum. However, after a few transferences, it can give fine cultures on gelose-potato.

While studying the properties of the bacilli killed by an alcohol-ether mixture it occurred to the writer to test their bacteriotherapeutic action upon ulcerative lymphangitis. The results obtained were most encouraging.

ROUX dishes are inoculated with bacilli grown upon coagulated serum. The resulting crop upon the gelose-potato of the dishes is emulsified, after 24 hours incubation at 37° C., in a physiological salt solution.

The emulsion is then centrifugated and the germs killed by adding equal portions of alcohol and ether.

The liquid is left in this way for a night, decanted and either stove or vacuum dried. A large store of germs is thus obtained and the vaccine can be prepared as wanted. All that is required is to emulsify the powder obtained with the physiological salt solution, warm for 2 minutes at 100° C and inject beneath the skin of the neck or shoulders.

The animal stands the injection well; the temperature reaction is weak, 0.5° to 1° C.; the general reaction is nil, there is no loss of appetite and all the other functions remain normal. A small œdema forms at the point of inoculation and disappears at the end of one or two days. The number of injections required varies according to the seriousness and duration of the disease: usually 2 or 3 are sufficient, sometimes a 4th. injection is useful but this is not often the case.

Local attention should be given; washing with antiseptic or painting with tincture of iodine.

After the 1st. injection, towards the 4th. day, the ulcers begin to dry up and the tendons relax. After the 2nd. and 3rd. inoculations, the improvement is obvious, the limb regains its mobility and the skin becomes normal.

Contrary to what is the case with the usual treatment, no relapse has been remarked in animals cured (in one case a year has passed since inoculation) by this method. Further not a single case of elephantiasis of the limb has been observed. The animals treated and cured by the writer are now employed as cab-horses and in spite of their hard treatment show no trace of their old trouble.

562 **Experimental Work upon Equine Trypanosomiasis in Morocco.**—VELU, H. In *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 3, pp. 253-260. PARIS, May 11, 1917.

The work under notice was carried out at the Research Laboratory of the Stock-raising Department at Casablanca, Morocco.

Messrs. SERGENT, L'HÉRITIER and BELLEVAL (*Bulletin de la Société de Pathologie Exotique*, Vol. VIII, p. 433, July 21, 1915) have identified *Trypanosoma maroccanum* n. sp. as being the causal agent of an epizooty

among horses which is very common in Morocco and has a clinical aspect of quite a special character.

The writer, who has already drawn attention to this disease (*Ibid.*, 1915, p. 115 and p. 646) has carried out experiments upon the behaviour of this trypanosome in several different animal species (mules, dogs, rabbits, rats, sheep, goats). For purposes of inoculation, parasites were used from 6 different horses.

The results were as follows:

The trypanosome was shown to be very virulent for the white rat which, after an incubation period of 3 or 4 days, showed acute infection lasting over an average period of 7 to 10 days. Autopsy showed the spleen to be enormously enlarged.

The rabbit is apparently little affected. The disease assumes a chronic aspect and develops slowly and irregularly. Symptoms and lesions are the same as those produced by the other trypanosomes in these animals.

Following inoculation, the dog showed infection of the sub-acute type with frequent bouts of fever. The almost constant presence of the trypanosome in the blood of the animals makes the course of the illness easy to follow.

In the case of 2 mules, the disease ran a much more rapid course than that in the horse resulting from natural infection; the period was 68 to 98 days. The incubation period after intravenous inoculation was 9 and 5 days. Passage through the rat seems to have increased the virulence for the mule. No oedemas were noticed.

Two goats and two sheep inoculated never showed any trypanosomes in the peripheral circulation nor any symptoms other than attacks of fever and loss of weight. The 2 goats recovered, one after 13, the other after 12 months.

563 - **Tuberculosis of the Goat.**—MORSEY, M., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 12, pp. 341-348, Paris, March 27, 1917.

Although tubercular lesions of any kind are rarely found in slaughtered goats, the general opinion that these animals are never attacked by tuberculosis is quite erroneous.

The question of tuberculosis in the goat is of great interest, not only from a scientific point of view, but also from that of public health. The goat is often called "the poor man's cow", and is much used in the vicinity of towns, and especially round Paris, for the artificial feeding of infants, and many families of the working-class keep goats under fairly precarious conditions.

There is no doubt that tuberculosis is rarely found in goats, that the clinical symptoms may often be confused with those of other diseases, more particularly verminous bronchial-pneumonia, and that the disease is unsuspected during life and recognised only after death. It should also not be confused with parasitic pseudo-tuberculosis frequent among small rodents.

There is absolutely no doubt that goats are susceptible to tuberculosis. From an experimental point of view goats may easily be infected

with bovine tuberculosis by intravenous inoculation. They may also contract it by living for a prolonged period amongst cows. This was conclusively proved by experiments in which young goats from a small herd, and sheep, were left to wander at liberty about a stable in which tubercular cows were housed. An average period of 1 year of stable contamination was necessary for the goats to develop the disease, whereas the cattle contracted it in a few weeks or a few months and the sheep only after 2 years. Once the herd of goats was infected, the other animals were contaminated in a relatively short time.

It seems that the tubercle bacillus only establishes itself with difficulty in the goat during the 1st. period of acclimation, but once this period is past, the contagion spreads fairly rapidly.

Natural tuberculosis was observed in a herd of 16 goats in the eastern suburb of Paris. During the year 1916 three of these goats died and the *post mortem* examination of one of them (made by the veterinary surgeon, M. GUÉNIOT) showed tuberculosis to be the cause of death. The 11 surviving animals were then subjected to the intrapalpebral tuberculin test; 6 gave a positive reaction; the 5 youngest did not react. Here, therefore, was a herd attacked naturally by tuberculosis of unknown origin. The animals were used for the production of milk, and more than half of them were diseased.

It has been proved experimentally that, if goats contract bovine tuberculosis, they only contract human tuberculosis with great difficulty. There is a marked difference between the human and bovine bacilli, but it is only a question of acclimation and the author has been able to bring about the passage of the one species to the other.

The author concludes that insufficient attention is paid to the question of milk used as food for children and old people. Even in the case of goats the sanitary condition of the animal supplying the milk should be controlled, above all from the point of view of tuberculosis.

564 - **The Nutrients Required to Develop the Bovine Foetus.** - ECKLES, C. H. in *University of Missouri College of Agriculture, Agricultural Experiment Station, Research Bulletin* 26, pp. 1-36. 23 plates - 4 diagrams. Columbia, Missouri, November 1916.

Under ordinary conditions the cow uses food for one or more of five purposes. These are: 1) maintenance, 2) milk production, 3) gain in body weight; 4) growth, 5) development of the foetus. Experimental data are available regarding the nutrients required for each of the first four. Feeding standards have been calculated from these data and are generally considered sufficiently accurate to be of practical use. No experimental data have been found concerning the nutrients required for the last, the development of the foetus, although some results have been published of experimental work closely related.

This investigation carried out by the writer is an attempt to determine the nutrients required to develop the bovine foetus.

At the close of an investigation carried out to determine the cause of wide variation in milk production by dairy cows, two cows were available and the necessary data partly taken to make this study possible.

These cows had been kept farrow and the maintenance requirements determined for a period of 180 days for one, and for 150 days for the second. During the maintenance period both received the same ration except as it was necessary to vary the quantity on account of the difference in size of the two animals. A digestion trial was conducted for each during this maintenance period. It was then planned to breed these cows and continue them on exactly the same ration, both in kind and quantity, during gestation. The effect of gestation would then be measured upon the cow herself rather than in terms of feed, taking into consideration the weight and condition of the cow after parturition. At a later date three more cows were available which had received precisely the same treatment as the two first mentioned, their maintenance requirements having been determined for a period of six months. A digestion trial had also been carried out for each during this maintenance period. It was planned to breed two of these cows, using the third one as a check, the rations being kept in the same proportion as had been found necessary during the maintenance period. By following this plan of using a check animal, any variation that might be due to the influence of the season of the year or quality of feed would be controlled by the check animal. The results were to be measured as in the first experiment by the effect upon the cow rather than by the amount of feed consumed.

After the results of the first experiment were available the original plans of the investigation were enlarged and the cooperation of the department of agricultural chemistry of the Missouri Experiment Station was secured for the purpose of taking data in regard to the composition of the foetus at birth. A portion of the results of these analyses have been published (1) and the remainder will be made public at a later date.

The results of these two investigations presented in this Bulletin in 23 Tables and 4 Diagrams, and amply discussed by the writer lead to the conclusion that the amount of nutrients necessary to develop the bovine foetus is so small that it cannot be measured by ordinary methods of experimentation.

In fact, the cows developed calves of normal size for the breed on a maintenance ration only sufficient to maintain them at uniform weight when not pregnant and not producing milk, and one cow weighed forty-eight pounds more after the calf was dropped than when bred and the others weighed only seventeen pounds less.

These results may be due to one or more of three possible factors: 1) better use of feed during gestation; 2) decreased maintenance during pregnancy; and 3) small amount of dry matter in foetus.

The conclusions with reference to these three factors may be summarised as follows:

1). While the data taken are not very satisfactory, the indications are that the coefficient of digestibility is not changed by pregnancy.

(1) THORNTON, P. F. Composition of the bovine foetus. *Proceedings of the American Society of Animal Production*: 100-104, 1915.

2). The data do not make it possible to conclude definitely that the maintenance of the animals is decreased by pregnancy, but it is thought this is probable, and could be accounted for by the animal being quieter when in this condition.

3) The data show that the amount of dry matter contained in the foetus and its accompanying fluid and membranes is very small. The small feed requirements necessary to supply the dry matter of the foetus together with the amniotic fluid and placenta, is either too small to be measured on account of the length of time represented or is offset by the saving due to decreased maintenance.

Four Jersey calves analysed at birth contained an average of 73.09 per cent. of water. Data available indicate that breed is not a factor influencing the composition of the new born calves. The amniotic fluid weighs about thirty pounds and contains approximately 95 per cent. of water. The placenta weighs about 18 pounds, of which approximately 85 per cent. is water.

A Jersey cow produces a total of only 15 or 20 and a Holstein 20 or 25 pounds of dry matter in the foetus and its accompanying fluid and membranes.

On the dry matter basis a Jersey calf at birth is equivalent to from 110 to 170 pounds of Jersey milk. In the Holstein breed the calf at birth will contain as much dry matter as from 200 to 275 pounds of Holstein milk.

Using the Jersey cow as typical of all, it is shown that she produces during one year 1263 pounds of dry matter in her milk. During this time 2828 therms of energy were available in her ration for this milk production in excess of maintenance. Her calf, with placenta and amniotic fluid, contained approximately 24 pounds of dry matter or 1.9 per cent. as much dry matter as in her milk for one year.

If the calorific value of the solids in the foetus are considered equivalent pound for pound to that of the solids in the milk, it would appear by calculation that this cow would require 1.9 per cent as much energy as was used for her milk production, or 47.7 therms. The actual energy in the foetus and its accompanying fluid and membranes calculated from the weights and composition was 56.4 therms, a figure surprisingly close to calculated requirement of 47.7 therms.

All the data available indicate that the weight of a calf at birth is not ordinarily influenced by the ration received by the mother during gestation. This is especially true with reference to the energy value of the ration, but may not hold good when the ration has been decidedly deficient in some constituent for a long period.

565 - **New Feeding-Stuffs used in Germany during the War.** — KLING, M. (from the Agricultural Station of the Speyer district), in *Landwirtschaftliches Jahrbuch für Baden*, Year 6, No. 11-12, pp. 483-513. Munich, 1916.

A large number of feeding-stuffs which have been placed on the market since the war and recommended either as new foods or as substitutes, have been analysed and examined at the Agricultural Station of the Speyer district. This paper deals with the foods received for analysis from the 1st. April to the 1st. October, 1916. The following are the most important

1) *Rhubarb Leaves*. — Up to the present these leaves have been left in the fields to be dug in as manure; now they are recommended as food for cattle. Their chemical composition is:

Moisture	60.02 %	Nitrogen-free extract . . .	3.86 %
Crude protein	2.78	Crude fibre	1.04
Crude fat	0.40	Ash (chiefly sand)	1.90

The leaves are very rich in moisture, but their dry matter contains solids of high nutritive value, especially in protein. The dried leaves are said to be better than hay of the first quality and might be fed to pigs. Reference should, however, be given to the green leaves.

2) *Seaweed*. — Both dried and fresh seaweed has been put on the market. The analysis of samples of *Fucus vesiculosus*, both when dried and when fresh, gave the following results:

	Fresh Seaweed	Ground Dry Seaweed
Moisture	37.97 %	11.82 %
Crude protein	10.52	6.59
Crude fat	1.65	3.33
Nitrogen-free extract	26.78	41.93
Crude fibre (König's method)	8.95	20.00
Ash	14.13	16.32
	100.00 %	100.00 %

If the solids of these two foods are compared, it is seen that their chemical composition is not quite identical. Fresh seaweed is richer in crude protein than ground dry seaweed but poorer in crude fat and crude fibre. As a rule seaweed contains little protein or fat, but a large quantity of nitrogen free extract and crude fibre.

Experiments made in Norway and France, and, recently, at the "Kaiser Wilhelm Institut" at Dahlem (Berlin), show that this food may well be given to animals. No trace of its smell could be found either in the meat or eggs of experimental animals. It has not yet been determined to what point its nutritive elements are utilised by animals, but its nutritive value appears to depend chiefly on its nitrogen-free extract, which consists principally of lichen starch, arabinose, d-galactose, etc. The crude fibre is probably also easily digested. However this may be, it seems most advisable to give the seaweed in the ground, dry state, as a supplementary food, especially for cattle and pigs. Its nutritive value must not be overrated. Fresh seaweed should not be transported great distances as it is liable to go bad.

3) *Straw Meal*. — This is much used, but is often put on the market under false names. The same meal was analysed under three different names. — "Futtermehl aus Getreideabfällen" (meal made from cereal by-products); Pflanzenfuttermehl F. (vegetable meal F) and "Futtermehl für Jungvieh und Schweine, Sorte 3" (meal for young cattle and pigs, type 3).

In all three cases the samples consisted of ground straw of cereals. The prices were respectively M 38.5, M. 28, and M. 50 per quintal (1).

Feeding experiments carried out with this meal, and its chemical composition, both prove this food to be unsatisfactory for pigs, cattle and horses, and the price out of all proportion to its actual nutritive value. The same may be said of the product called "Erbsenstrohmehl" (Pea-stalk meal), which is also widely distributed on the market.

4) *Spelt Chaff Meal*. — Finely ground spelt chaff is a product sold under a false name and at very high prices. Two samples, under the names of "Futtermehl" (fodder meal) and "Weizenmehlkleie" (wheat-flour bran) respectively, were composed almost entirely of ground spelt chaff and only contained traces of flour. Their value does not exceed that of the whole chaff, and their use is not recommended.

5) *Concentrated Straw Fodder; Concentrated Straw Fodder with Albumen added*. — By boiling straw in an alkaline solution under pressure a concentrated, easily digested food is obtained. Part of the solids, including the crude protein and the greater part of the nitrogen-free extract is lost, but the crude fibre becomes more digestible and, as compared with the solids, has the same starch value as pure starch.

This process has been introduced into Germany by OEXMANN. The cellulose prepared as above is mixed with molasses and the whole dried. About 30 parts of molasses should be mixed with 70 parts of moist straw. The product, "Strohkraftfutter" (concentrated straw fodder) is highly recommended. Its chemical composition is given below:

Moisture	9.30%
Crude protein	3.55
Crude fat	0.37
Nitrogen-free extract	29.04 (11.7% of which is sugar)
Crude fibre	53.04
Ash	4.79

Its starch value is 70 to 75 kg. per quintal. It contains little albumen and its crude protein, consisting of the amides of the molasses, cannot entirely replace this want.

For this reason, matter rich in albumen has been added to this product and the mixture is known under the commercial name of "Eiweissstrohkraftfutter" (concentrated albumen straw fodder). Dried yeast was first added as albuminoid, but now ground lupin seeds freed from the bitter elements are chiefly used. The sale of this product has been taken over by the "Bezugsvereinigung der deutschen Landwirte" (Cooperative Association of German Agriculturists, Berlin), which distributes it to farms through the agency of the "Landesfuttermittelstellen" (district office for the distribution of fodder) or the "Kommunalverbände" (municipal federations). Analysis showed it to have the following composition:

	Sample I	Sample II
Moisture	10.82 %	8.83 %
Crude protein	10.75	6.00
Fat	0.32	0.25
Nitrogen-free extract	44.99	41.62
Crude fibre	28.10	34.17
Ash	5.02	6.13
	100.00 %	100.00 %

In both samples lupin seeds freed from their bitter elements were added to supply the deficient albumen.

The results of feeding experiments showed that the concentrated straw fodder with albumen added was a suitable food for all animals. It replaces oats for horses, for which it is an excellent food, and is equally suitable for cattle. Good results were also obtained when the ration of pigs was composed of from $\frac{1}{6}$ to $\frac{1}{4}$ of this product.

6) *Crushed and Ground Maize Ears.* — A sample of crushed ears ("Maiskolbenschrot") was composed of ears coarsely ground with traces of flour. Their price was 38 Marks per quintal and their composition as follows :

Moisture	6.81 %	Nitrogen-free extract	49.91
Crude protein	3.10	Crude fibre	34.17
Crude fat	0.32	Ash	2.37

As its feeding value does not exceed that of wheat chaff, its use is not advised.

7) *Heather Stalks.* — An excellent food may be prepared with the leaves, flowers, seeds and fine stalks of heather, but very woody stalks only have a minimum feeding value. Their composition is :

Moisture	6.60 %	Nitrogen-free extract	45.38 %
Crude protein	4.18	Crude fibre	53.47
Crude fat	1.00	Ash	2.50

8) *Kohl-Rabi By Products.* — Two foodstuffs have been prepared with the peelings and partially putrified roots. The decomposing roots, made into slices and then dried, give a fairly good food (9 to 10% moisture; 9 to 10 % protein; 1 to 5 % fat; 40 to 58 % nitrogen-free extract). The decomposition of the roots must not, however, be too far advanced, neither should the food contain more than 10 % moisture and 1 % of impurities (sand, clay, etc.)

The second food (9 to 16 % of moisture; 10 to 12 % of protein; 0.92 to 1.13 % of crude fat; 41.63 % of nitrogen-free extract) prepared with peelings, contained so high a proportion of sand and other impurities that it could not be used with safety. When buying it great importance must be attached to purity and all goods containing much sand should be refused.

9) *Ground Sugar-Beet Seeds.* — Seeds which have lost their germinating power are ground and sold as feeding-stuff. A sample had the following composition :

Crude protein	11.65 %
Crude fat	4.42
Ash	8.96

Apart from a small quantity of mineral impurities, the sample was composed of fairly pure ground sugar beet seeds. The nutritive value of these seeds is about $\frac{2}{3}$ that of wheat bran and it is particularly well suited to cattle and horses.

10) *Parsley Seed.* — A large quantity of unsold parsley-seed was put on the market as food for cattle. Its composition is given below :

Moisture	11.50 %	Nitrogen-free extract . .	36.04 %
Crude protein	13.75	Crude fibre	6.50
Crude fat	23.40	Ash	8.81

This food should be given to animals that are receiving rations poor in stimulants (potatoes, roots, rain-soaked hay), but the amount should be moderate. The seeds should be crushed and the price low.

11) *Wild Radish Husks.* — The husks of the wild radish (*Raphanus Raphanistrum*), which are often found in cereal meals, are eaten by the cattle to whom these meals are given. In a sample of barley meal was found 41 % of these husks with the following composition :

Moisture	6.50 %	Nitrogen-free extract . .	43.32 %
Crude protein	10.00	Crude fibre	30.40
Crude fat	6.78	Ash	2.60

These husks, whose nutritive value is 40 % that of good barley, may be fed to cattle and to horses, but not to pigs.

12) *Roumanian Bran.* — Before Roumania came into the war Germany imported from that country large amounts of bran (wheat and rye). Later farmers frequently complained that, after eating this bran, pigs became ill and even died. Samples of the suspected bran were analysed chemically and microscopically, but not bacteriologically. Their composition was normal and the sickness and death of the pigs do not seem to have been caused by this product.

13) *Mixture of Brewers' Grain and Yeast.* — By a special process the dry grains are mixed with the moist yeast, and the whole dried. This product, differing little in appearance from dry brewers' grains, has the following composition :

Moisture	7.18 %	Nitrogen-free extract . .	37.58 %
Crude protein	30.80	Crude fibre	13.63
Crude fat	5.63	Ash	5.18

This food contains about 75 % of grain and 25 % of yeast, and is suited more especially to horses and cattle.

14) *Wine yeast.* -- The yeast of fresh wine cannot be used as a food until the large quantity of tartar it contains (as much as 25 %) has been removed. This is done by washing and the yeast made into a cake. Its composition is:

Moisture	60.33 %	Nitrogen-free extract	3.86 %
Crude protein	12.86	Crude fibre	14.61
Crude fat	5.47	Crude ash	2.92

The average amount of 1.65 % of tartaric acid corresponds to 2 % of tartar and may be neutralised by calcium carbonate. As yeast cake soon becomes slimy it should not be kept long. The yeast with which it is prepared should be cooked.

No experiments have yet been made on the digestibility of wine yeast freed from tartar, but it appears to be easily digested. The best results are obtained by feeding it to pigs at the rate of 0.44 lbs. to 1 lb. per head per day. Cattle, particularly dairy cows, eat it readily (3.30 to 4.40 lbs. per head per day). It is less suited to horses.

15) *Ground Grape Pips.* -- In Germany the residue of grapes is distilled to extract the alcohol. The pips are either crushed for their oil or ground into a food with the following composition:

Moisture	13.46 %	Nitrogen-free extract	35.16 %
Crude protein	10.00	Crude fibre	20.52
Crude fat	7.00	Ash	4.92

This food, therefore, is very rich in crude fibre, with a nutritive value closely corresponding to that of medium quality meadow hay. If the pips are ground after the oil has been extracted the food has less value.

16) *Beechnut Cake.* -- The analysis of whole ground beechnuts gave the following results:

Moisture	16.75 %	Nitrogen-free extract	28.88 %
Crude protein	18.50	Crude fibre	19.07
Crude fat	4.40	Ash	11.20 (6.5 % is sodium chloride).

Sodium chloride (cooking salt) had probably been added to make the animals accept better this food which is very rich in tannin. Its starch value is 40 kg. per quintal, and it is well suited to cattle. The price asked, 31 Mark per quintal, is much too high.

17) *Walnut Cake.* -- Cattle much appreciate cake made of nuts without their shells. Sometimes the nuts are pressed with their shells, as was the case with nut-cake from Roumania and Bosnia whose composition is given below:

Moisture	6.55 %	Nitrogen-free extract	40.29 %
Crude protein	9.50	Crude fibre	23.79
Crude fat	9.00	Ash	1.06

The fodder value of this cake is about equal to that of beechnut cake.

18) *Fish Meal*. — Fish meals are rare in Germany now, and their quality has deteriorated. A sample examined contained, besides 41.10 % of protein and 3.33 % of fat, 25.59 % of cooking salt. This high percentage of salt is detrimental to the health of the animals, indeed, it is recently supposed to have been the cause of numerous cases of sickness and death among pigs. Fish meal, such as the above, should only be fed in very small quantities, and no salt ration should be given with it.

19) *Foods for fattening Pigs*. — These food-stuffs are put on the market either by the above-mentioned Cooperative Association of German Agriculturists, or else by private firms.

A food of this description composed chiefly of crushed maize with a little ground maize ears and acorn meal contained 9.84 % of crude protein, 3.36 % of fat and 2.29 % of ash. This may be considered satisfactory.

Another food made with corn bran, crushed corn, barley, oats, acorn meal, ground seeds of weeds, seaweed meal and fish meal contained 11.8 % of water, 15.15 % of protein and 5.08 % of ash. This is also recommended.

A 3rd. food composed of seaweed meal, the tegument of coriander fruit, potato pulp, the by-products of preserves, and crushed bones, was of slight value only. Another food consisted of 25 % of crushed bones, 8 % of maize, 5 % of corn bran, 12 % of beetroot slices, and 50 % of vegetable meal (chiefly pea-straw meal). It contained 15.7 % of protein, 3.71 % of fat and 21.33 % of ash. Its use is not advised.

A 5th. food was composed of peanut husks, oat chaff, straw meal, barley chaff, calcium phosphate, crushed seeds of weeds, and spelt chaff. It contained 4.38 % of crude protein and 14.84 % of ash. As its nutritive value is nil, its use is not recommended.

A 6th. meal was made of straw, chaff, dried ground grape residue, bones crushed with a little meat, cooking salt, and impurities. It contained 19 % of crude protein, 22.2 % of nitrogen free extract, 2.09 % of crude fat and 35.08 % of ash. Its use is also not recommended.

20) *Poultry Food*. — All sorts of by-products of little value as now being sold as poultry food. One of these foods, containing 17.5 % of protein, 3.03 % of fat and 40.76 % of ash, was composed of whole seed of weeds, bad quality cereal seeds, leguminous seeds, beetroot seeds, grape residue, crushed bones, crushed mussel shells and much sand, and was sold at 1.5 *Mark* per kg. Its purchase at that price is not advised.

A 2nd. food made of rye attacked by smut, wood-charcoal and other impurities, caused symptoms of sickness in hens. Its price, 24 *Mark* per quintal, is considered excessive.

A 3rd. food called "Nährsalz Lukrativ" (Lukrativ feeding salt) has the following composition: — silicate powder, 18 %; calcium carbonate 35 %; sodium chloride, 7 %; magnesium sulphate, 11 %; sodium bicarbonate 8 %; sulphur, 2 %; Glauber salts, 18 %; calcium phosphate in small quantities. The price asked, as much as 0.90 *Mark* per kilo, is too high in proportion to its relatively low nutritive value.

21) *Horse Food*. — Under the name of "Pferdefutter" a food is sold which contains 9.75 % of protein, 1.73 % of fat and 9.67 % of ash. It is made up of corn chaff, dried beetroot slices, vegetable (pea) meal. The price, 36 *Mark* per quintal, is considered too high.

22) *Feeding Meal*. — A feeding meal ("Futtermehl") made at the Nuri Werke, at Strasbourg (Alsace), and sold at 48 *Mark* per quintal, had the following composition :

Moisture	9.60 %	Nitrogen-free extract	39.22 %
Crude protein	7.00	Crude fibre	29.28
Crude fat	2.73	Ash	12.17

A microscopical examination showed the presence of ground spelt chaff, ground grape residue, small quantities of straw meal and 2.5 % of cooking salt. It is, thus, a coarse food for cattle and horses, and its price is excessive.

A food sold under the name of "Pflanzenfuttermehl G" (vegetable fodder meal, G) was composed of seed-beet straw, cereal straw and woody stalks. Its nutritive value does not exceed that of straw meal.

566 - **Experimental Researches on the Nutritive Value of Maize; Raw, Sterilised and Decorticated.** — WEILL, E. and MOURIGAND, G., in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 8, pp. 372-375. Paris, April 21, 1917.

The writers have already drawn attention to the disturbances produced in animals (notably pigeons) by a diet of completely sterilised, or decorticated, seed (barley, wheat, rice, the seed of some Leguminosae) (1) and they have found that decortication is equivalent to sterilisation; the latter seems to kill the ferment, or group of ferments, contained in the cuticle, the former removes these substances with the cuticle.

In the article analysed, the writers describe their experiments with maize grain fed to pigeons; the birds received: perfectly raw maize — completely sterilised maize — decorticated maize. The results show:

1) The high nutritive value of maize when raw, and not decorticated; it produces quite special vigour in pigeons.

2) The destructive action exercised by sterilisation on the ferment contained by the cuticle.

3) The possibility of producing paralysis due to malnutrition by complete sterilisation of bread, as well as by decortication of the grain.

4) The dystrophic action (in certain cases) of decorticated grain on cutaneous nutrition (pellagra?).

567 - **The Propagation of Wild-Duck Foods.** — MCATEE, W. L., in *United States Department of Agriculture, Bulletin* No. 465, 40 pp., 38 figs. Washington, Feb. 27, 1917.

The Bureau of the Biological Survey of the U. S. Department of Agriculture is constantly requested to give information concerning the propagation of valuable wild-duck foods. The Bureau has endeavoured to meet the demand by issuing the following three publications: 1) *Biological Sur-*

(1) See: *B.* 1916, No. 415 — *B.* 1917, No. 260.

vey, Circular No. 81, Sept. 9, 1911; 2) U. S. Dept. Agr. Bulletin No. 58, Feb. 7, 1914; 3) U. S. Dept. Agr. Bulletin No. 205, May 20, 1915, which deal with the value, nature, habitat, methods of propagation, etc., of 19 groups of plants including more than 60 species.

The Bulletin No. 465 summarised below, consists of a revision of the first 2 publications and gives information as to the food value for wild ducks, description, distribution and propagation, of the following plants:

Wild rice (*Zizania palustris* and *Zizania aquatica*)

Wild celery (*Vallisneria spiralis*)

Pondweeds (*Potamogeton* spp.)

Arrowheads (*Sagittaria* spp., and especially *S. platyphylla* (detta potato); *S. latifolia* and *S. arifolia* ("wapato").

Chufa (*Cyperus esculentus*).

Wild millet (*Echinochloa crus-galli*).

Waterlily (species of the 3 families *Cabombaceae*, *Nelumbonaceae* and *Nymphaeaceae*, and especially: banana waterlily (*Castalia mexicana*).

Bulletin No. 205 deals with the following plants:

Musk grasses (*Algae*, *Characeae*)

Duckweeds (genera *Wolffia*, *Wolffella*, *Azolla*, *Lemna*, *Spirodela*, etc.)

Frogbit (*Limnobium spongia*)

Thalia (*Thalia divaricata* — *T. dealbata* — *T. burbata*)

Water Elm (*Planera aquatica*)

Swamp privet (*Forestiera acuminata*)

Eel grass (*Zostera marina*)

Widgeon grass (*Ruppia maritima*)

Water cress (*Sisymbrium Nasturtium-aquaticum*)

Water weed (*Anacharis canadensis* - *variegata*)

Coontail (*Ceratophyllum demersum*)

Many other plants cannot be obtained commercially, either as seeds or as other parts necessary for propagation, but are valuable as food for wild ducks. The following species are indicated by the writer as being the best.

Burreed (*Spartanium eurycarpum* and *S. angustifolium*)

Pondweeds (*Potamogeton heterophyllus* — *P. pusillus* — *P. filiformis* — *P. interior*)

Western widgeon grass (*Ruppia occidentalis*)

Horned pondweed (*Zannichellia palustris*)

Bushy pondweed (*Najas flexilis*)

Arrowhead (*Sagittaria longiloba* — *S. rigida* — *S. teres* — *S. graminea* — *S. papillosa*)

Grass (*Panicum condensum*)

Switch grass (*Panicum virgatum*)

Salt marsh grass (*Spartina cynosuroides*)

Cord grass (*Spartina Michauxiana* and *S. gracilis*)

Meadow grass (*Panicularia nervata*)

Bulrush (*Scirpus americanus* — *S. validus* — *S. occidentalis* — *S. paludosus* — *S. robustus* — *S. fluviatilis* — *S. cubensis*)

Sawgrass (*Cladium effusum*)

Sedge (*Carex decomposita*)

Wampee (*Peltandra virginica*)

pickerel weed (*Pontederia cordata*)

Smartweed (*Polygonum amphibium* — *P. pennsylvanicum* — *P. opelousanum* — *P. hydropiperoides* — *P. hydropiper* — *P. punctatum* — *P. sagittatum*)

Saltwort (*Salicornia europaea* — *S. ambigua*)

Water primrose (*Jussiaea leptocarpa*)

Water pennywort (*Hydrocotyle umbellata*)

368 - Is Lysine the Limiting Amino-acid in the Proteins of Wheat, Maize or Oats? —

MCCOLLUM, R. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 483-500, 12 diagrams + 4 plates. Baltimore, Md., January 1917.

The present paper is from the Laboratory of Agricultural Chemistry of the Wisconsin Experiment Station, Madison.

Data published in 1914 by OSBORNE and MENDEL (*The Journal of Biological Chemistry*, 1914, Vol XVII, pp. 325 and 334) were interpreted by them as indicating that maintenance, but not growth, of an animal is possible without the amino-acid lysine. This created the impression in the minds of several investigators that this amino-acid is the limiting factor in determining the value of many proteins of vegetable origin.

In the course of their studies directed towards ascertaining the supplementary relationships among the naturally occurring food-stuffs, the writers have obtained data which bear on this subject in a definite way. The results leave no room for doubt that a generalisation cannot safely be made that any one amino-acid, like lysine, is present in the protein mixture in our more common vegetable foods in amount relatively smaller than are other essential amino-acids. Indeed we are forced to the conclusion that in the protein mixture of the maize kernel and the oat kernel, lysine certainly is not the essential protein cleavage product which is present in an amount so small that it is the limiting factor which determines the biological value of the proteins of these seeds.

The rations employed by the writers were made up on the following plan. A food mixture consisted of a single grain so supplemented with organic salts and butter fat as to be properly constituted for promoting growth and prolonged well-being, except that the protein was too low in amount to promote growth at the normal rate. In all cases the rations were shown to be made highly efficient for growth by the addition of purified protein alone, when casein was employed. Casein is well known to be a complete protein, and to suffice as the sole source of nitrogen throughout the life of the rat. (Cf. *Journal of Biological Chemistry* 1915, Vol. XX, p. 415; Vol. XXIII, p. 231).

Rations made up in this way were fed without the addition and also with the addition of the incomplete proteins zein and gelatin respectively. The former yields no lysine while the latter yields about 6 %. Obviously if lysine were the one amino-acid whose addition is necessary in order to improve the protein mixture of the grain employed in the food mixture there should be a response with growth when gelatin is added and no improvement when zein is added.

The results may be summarised as follows:

1) Zein does not supplement the protein mixture in the wheat kernel or the maize kernel so as to improve the rate of growth of young rats.

2) Zein does supplement the proteins of the oat kernel in a surprisingly efficient manner, although it lacks tryptophane and lysine and is one of the poorest in cystine. In the proteins of the oat kernel, therefore, the above amino-acids are eliminated as being possibly the essential protein cleavage products present in minimal amount, and determining the plane of intake essential for growth.

3) Gelatin chemically supplements the protein mixture of both the wheat kernel and oat kernel respectively. Since gelatin contains no tyrosine or tryptophane, and but a trace of cystine, but contains 6 % of lysine, it is evident that neither tyrosine, tryptophane, nor cystine is the limiting amino-acid in these grains. It tends to support the view, but does not prove that lysine is the amino-acid whose addition alone to the wheat protein mixture raises the biological values of the latter.

4) The addition of wheat gluten to either the wheat or maize kernel protein supplements them so as to improve growth. The proteins of the wheat gluten are probably as a mixture qualitatively adequate as respects all of the indispensable amino-acids, although we cannot look upon this point as definitely established. One of its constituents, glutenine, has been shown by OSBORNE and MENDEL to be capable of supporting growth when it furnished 93.2 % and "protein-free milk" 6.8 %.

It seems probable, therefore, that the combinations, used by the writers, of wheat kernel proteins with wheat gluten led to growth because of a higher intake of protein rather than a supplementary relationship between the proteins from the two sources in the sense of one making good the amino-acid deficiencies of the other. The results of feeding maize proteins with wheat gluten are of particular interest, however, because of their pronounced effect in promoting growth despite the relatively low lysine content of both the wheat and maize proteins.

Gelatin with its high lysine content does not improve the proteins of the maize kernel.

569 - **Live Stock Production in the Eleven Far Western Range States, U. S. A.** - BARNES, WILL C. and JARDINE, J. T., in *U. S. Dept. of Agriculture, Office of the Secretary, Report No. 110*, 100 pp. Washington, July 1, 1916.

This report forms the second portion of the enquiry held by the U. S. Dept. of Agriculture into meat consumption and production (1). It relates to the following 11 Far Western Range States: Arizona - California - Colorado - Idaho - Montana - Nevada - New Mexico - Oregon - Utah - Washington - Wyoming and, particularly, to the land on and adjoining the National Forests.

The enquiry was conducted by 160 Forest Service Inspectors under the direction of the writers.

The data are presented in three sections:

1) Live-stock production on western ranges, including changes in production since 1910, the main factors responsible for these changes, and the possibilities for increase in production.

(1) See B. March 1917, No. 256.

- 2) Cost of production at present under western range conditions.
- 3) Brief discussion of conditions in each State included in the investigations.

The following are the main facts elicited by the enquiry.

CHANGES IN NUMBER OF CATTLE AND SHEEP SINCE 1910. — From 1910 to 1914 there has been a decrease estimated at 859 120 head of cattle and 4 537 578 sheep. Considering four sheep to be equivalent to one cow this is equivalent to a decrease of approximately 13 %.

The entry and settlement of 85 673 397 acres of land since 1909 in the States under notice is responsible for an approximate decrease of 16 % in animal production from that date; it is largely due to the dividing up of ranches formerly employed for ranging cattle and sheep.

The increase in prices and the development of farms in the range district has resulted in an increase in the cost of winter feeding and in a diminution of the area of pasture per head of cattle. These facts have partly counterbalanced the effects of settlement in relation to the decrease in numbers of cattle.

Among the factors responsible for the decrease from 1910 to 1914 may be mentioned: the uncertain outlook — difficulty of finding capital for purchase of breeding stock — increase in price of land and dairy stock — improvement in grade and weight of animals at the expense of numbers — drought and severe winters — range deterioration.

POSSIBILITIES OF INCREASED PRODUCTION IN THE FUTURE. — The conclusions reached under this head are as follows: The production of live stock in the 11 States under consideration is capable of a 15 % increase during the first 10 years, from 1915 to 1924 inclusive and this for the following reasons: a) the settlement of the 85 673 397 acres of range lands mentioned above will mean increased development of animal production; b) the carrying capacity of summer pastures, including those of the National Forests, will probably increase 15 % and winter feeding in the stable in the regions adjoining the National Forests will probably increase in a similar manner; c) the improved method of handling stock both on farms and ranges will mean a more economic utilisation of feeds and so the raising of an increased number of cattle with the same means.

This estimated increase of 15 % for the National Forest ranges will require improved breeding methods. Better use of pasturage can be made by sinking wells, building roads and bridges, etc., and this will allow of bringing into use an increased amount of range. The cooperation of the Forest Service will be required to help in attaining this result and the adoption of a liberal policy with regard to the construction of drift and division fences, roads, bridges, etc. In the 11 States in question there remain some 284 000 000 acres of unreserved and unallotted public lands, of which about 250 000 000 acres are essentially grazing lands. Under adequate control, with the necessary development and improvement, these lands would within 10 years probably carry 30 per cent more stock than at present. But without some form of control the best that can be hoped for is the maintenance of the present carrying capacity.

TABLE I. *Averages, by States, of data supplied by stockmen in answer to question schedule.*

State	Length of grazing period	Per cow and calf	Cost of branding	Pasture and fodder consumed up to 1 year	Duration of winter feeding	Winter feed consumed per head of cattle from yearlings up	Average cost of winter feeding where carried out by contract	No. of bulls per 100 cows	Average value of bulls	Average no. of calves born per 100 cows	Calves up to 1 year	Percentage loss of cattle from all causes	Yearly depreciation of range cows	Yearly depreciation of bulls	Rate of interest for loans on cattle	7 years old	3 years old	1 year old	Yearly labour cost per head of adult cattle	Rate of taxation per \$ 100	Head valuation for purposes of taxation
	month	\$	\$	\$	months	\$	\$	%	\$	%	%	%	%	%	%	lbs.	lbs.	lbs.	\$	%	\$
Arizona	12	4.76	3.16	—	—	—	—	6.33	82.63	57.60	8.30	4.40	6.40	6.00	12.70	9.90	774.0	938.0	2.13	2.02	23.01
California	10	6.22	3.81	11.81	2.00	7.13	9.3	3.73	94.75	73.35	6.76	4.15	4.13	4.95	17.22	8.10	948.2	1,140.6	2.94	2.12	19.19
Colorado	7.4	3.35	2.13	9.81	4.60	8.50	8.80	4.10	133.00	69.30	8.01	4.90	4.54	5.26	18.32	8.82	861.0	1,084.5	2.76	2.30	33.60
Idaho	7.5	2.75	2.15	8.15	4.00	8.80	8.00	4.00	100.00	75.00	7.68	4.00	3.00	12.00	10.00	10.00	1,000.0	1,200.0	2.95	2.00	30.00
Montana	8.0	3.67	3.07	9.02	4.60	8.04	9.00	3.44	137.00	75.80	7.01	3.85	2.74	4.74	17.30	9.60	944.0	1,211.0	3.87	2.63	29.69
Nevada	8.0	3.00	2.50	7.75	3.50	7.87	7.15	4.00	145.00	70.00	6.00	4.00	4.00	6.00	17.60	8.00	940.0	1,140.1	2.75	1.88	20.00
New Mexico	11.7	3.34	1.10	1.00	0.20	—	—	5.50	83.00	66.00	10.00	5.00	5.00	5.80	13.40	10.20	725.0	934.0	2.77	4.62	26.00
Oregon	8.50	1.94	3.51	7.9	3.43	7.04	8.05	4.94	113.35	78.74	5.13	3.27	3.00	3.35	13.50	8.42	773.7	1,185.9	3.53	1.85	25.80
Utah	9.0	2.00	1.60	7.65	3.50	7.60	8.15	4.00	133.00	69.00	6.00	3.00	5.00	8.00	15.00	8.00	900.0	1,080.0	2.95	3.05	20.00
Washington	7.9	5.47	5.19	8.61	4.10	9.02	12.20	3.70	124.15	79.48	5.33	4.28	3.29	5.24	14.70	8.70	1,035.0	1,225.0	3.71	3.20	25.61
(1) Wyoming, District No. 1	7.8	2.70	3.70	8.60	4.15	6.64	7.10	5.85	100.00	73.20	5.87	3.02	2.79	3.58	18.00	6.50	927.0	1,155.0	2.33	1.62	30.42
Wyoming, District No. 1	7.0	3.14	1.80	9.73	5.00	8.13	8.88	4.00	111.00	83.00	7.60	3.00	3.00	7.00	12.00	9.00	1,075.0	1,300.0	1.87	2.80	35.00

(2) These are the district divisions of the Forest Service. District 4 covers the Teton and Windy Mountain National Forests south of Yellowstone Park and lying adjacent to the Idaho State line. District 5 covers the rest of the State.

By the use on the ranges of a higher grade and a greater number of bulls, the separation of breeding stock from dry stock and better care and management of the breeding animals throughout the year, it should be possible to increase the number of calves 10 per cent and the average weight of a 2-year old steer perhaps 30 lbs. .

COST OF PRODUCTION UNDER WESTERN RANGE CONDITIONS. — The greater part of the data under this heading was furnished by the leading breeders in the form of answers to a question sheet distributed by the Inspectors of the Forest Service.

Table I shows, in the form of averages, for each State, the data supplied; these latter are of special interest for the study of the Western range pastures apart from the costs of production which have been calculated by their aid. Before proceeding to the calculation of the cost of production, the data have been carefully examined by the writers in person, zone by zone, with the same schedule of questions in order to obtain check data as accurate as possible.

In addition to the data in Table I the report reproduces a number of accounts supplied by some big stock-raising enterprises. These are compared with the average expenses calculated by the writers.

For instance, the following statement is from a large range outfit in central Arizona which ranges 17 000 head of high-grade cattle.

Sundries	\$ 4 825.00
Labour	14 317.00
Supplies	5 753.00
Feed	23 870.00
Taxes	4 706.00
Total cash outlay	53 471.00
Cost per head based on actual running expenses	3.13

Of these 17 000 head, 8 333 are bearing cows, 416 are bulls, the balance, about 8 250 head, are mixed young stock. A depreciation charge of 5 % for cows and 15 % for bulls would run the above total to \$ 80 546 or a total cost of \$ 4.74 per head. Dividing the 5 000 calves produced into this \$ 80 546 cost and depreciation, gives a cost of \$ 16.11 to produce one calf, but this, of course, makes them bear the burden of the whole herd, which is hardly fair.

The average annual branding for the company is 5 000 calves, or about a 60 % crop. The company pays 48 cents per head for grazing fees on the National Forests for the year-long period for a small number of their cattle, the majority of them being grazed on a near-by Indian reservation at a cost of \$ 1.50 per head. The company's total investment is approximately \$ 500 000. In the States of Arizona, New Mexico, South Colorado and Texas, outfits pasturing over 2 000 head work under practically similar conditions.

Table II shows the cost, by States, of producing a yearling and a 2-year old, as compiled from the data collected by the writers.

TABLE II. — *Average Cost, by States, of producing a yearling and a 2-year-old steer or heifer.*

State	Yearling	Two-year-old
<i>Arizona:</i>		
Average figs. of Table I	19.45	25.47
Special report of large range outfit	15.43	20.50
<i>California:</i> Average figs. of Table I	27.57	40.00
<i>Colorado:</i> Average figs. of Table I	30.50	43.46
<i>Idaho:</i> Average figs. of Table I	31.34	45.19
<i>Montana:</i>		
Average figs. of Table I	32.89	47.90
Special report for eastern Montana	26.90	35.60
<i>Nevada:</i> Average figs. of Table I	31.25	44.46
<i>New Mexico:</i> Average figs. of Table I	18.30	25.30
<i>Oregon:</i> Average figs. of Table I	31.13	45.70
<i>Utah:</i>		
Average figs. of Table I	31.43	44.00
Schedules in southern Utah only	19.68	24.31
<i>Washington:</i> Average figs. of Table I	33.45	50.53
<i>Wyoming:</i>		
Average figs. of Table I	31.85	47.11
Special report of large outfit	25.75	37.20

570 — Hereditary Transmission of the "Curly Wool" Character of Karakul Sheep in Crosses between the Karakul and Rambouillet Breeds; Research carried out in Austria. — ADAMETZ, LEOPOLD, in *Zeitschrift für induktive Abstammungs- und Erbschaftslehre*, Vol. 17, Pt. 3, pp. 161-202, Leipzig, March 1917.

Breeders of Karakul sheep (1) of the Bokhara district (Central Asia), as well as most fur merchants of central Europe, consider the lock of Karakul lambs to be a specific product of their native habitat, outside which this character is not maintained. This was also Darwin's theory.

In order to clear up this point and to gain a better knowledge of the inheritance of the curl, crossings between Karakul sheep and Rambouillet sheep (whose lambs have straight wool) were carried out at the experimental farm of the "K. K. Hochschule für Bodenkultur" (High School for Agriculture) at Gross-Ezersdorf (Austria). Unfortunately the experi-

(1) See also *B.*, January 1917, No. 64.

ments were unavoidably carried out under rather unfavourable conditions: as only 50 animals were available, only pure-bred Karakul rams were crossed with pure-bred Rambouillet ewes. In spite of their deficiencies, the experiments permitted the determination of the principal factors in the inheritance of the Karakul curl. The results were compared with those obtained by other breeders from crosses between the Karakul and Zackel breeds (2).

RESULTS OF THE EXPERIMENTS. — 1) The Karakul curl is a strictly hereditary character which is transmitted even if Karakul sheep are crossed with other races of which the lambs have wool which does not curl.

2) With regard to this character such crossings produce characteristic Mendelian segregations.

3) The capacity of Karakul sheep to form these typical locks is, therefore, a character which is never caused by the natural conditions of the Bakhara district, but is rather a phenomenon of domestication due to a mutation.

4) The capacity of forming Karakul locks is probably an incomplete dominant character in the Mendelian sense, as is the case with curls in certain human hair.

5) The incomplete dominance of the formation of curls is also seen by the fact that, already in the hybrids of F_1 , the fleece of the lambs varies greatly; some of the animals have no curls, others have curls like those of pure-bred Karakuls of the 1st. quality, and there are all kinds of intermediate animals.

6) With regard to the hereditary force of curl formation, especially in the F_2 generation the results vary in the different Karakul rams; this may be attributed to the individual strength of the animals.

7) The extent of curl formation in the lambs of the F_1 generation depends also, all else being equal, on the second race without curls chosen for crossing. Breeds with mixed wool ("Mischweilrassen"), especially the Zackel breed give very good quality curls in the F_2 generation; on the other hand, Merino sheep give bad quality curls. The absence of curls in the fleece of lambs derived from crossing Karakul and Rambouillet breeds is the result of atavistic crossings.

8) As the curls only appear in very young animals, their formation may be described as an incomplete and temporary dominant.

9) The varying behaviour of the hairs which form the curl at the different stages of the development of the fleece leads to the supposition that there is a close relationship between curly flat-lying hair on the one hand and curly, vertical hair and very wavy and slightly wavy hair on the other.

10) It is clear that the shape of the lower part of the follicle cannot be the cause of this varying behaviour of the hairs.

11) The mode of action of the mechanical forces during the formation of Karakul curls is not known.

12) The histological character of the different kinds of hair cannot, therefore, form a practical base in the choice of factors.

13) Unlike the less complete curls in human hair due to one factor only (in the white race, according to DAVENPORT), or, at the most to 2 factors (in Hottentots with very curly hair, according to FISCHER), the appearance of the of the Karakul curl, so far as can be judged by the results obtained, is probably caused by more than 2 factors.

14) If the manner in which the locks are transmitted within the pure-bred Karakul race itself is considered, it appears probable that a great many factors are concerned, all of which act in the same sense ("polymerism"), according to NILSSON-EHLE's theory.

15) The hypothesis that the capacity of forming curls in the Karakul race depends on a large number of factors acting in the same sense is corroborated by the fact that in the more complicated crossings made by the author ($F_2 \times F_2$ and $F_1 \times F_2$), there were often lambs whose fleece pointed to a sort of intermediary inheritance.

16) This explanation is contradicted by the fact that, even after repeated reciprocal crossings on the Karakul side, there still appear from time to time lambs without curls. This is probably a case of heterozygotes of a recessive type. The author considers improbable DAVENPORT's hypothesis, that there exists a force which exercises a different activity, and, according to the circumstances, can cause these incompletely dominant characters to develop or else leave them in the latent state.

571 - **The Cost of Raising Leghorn Pullets.** - PHILIPS, A. G., in *Purdue University Lab. Idm.*, Vol. IX, No. 196, 20 pp., 6 fig. Lafayette, Indiana, December, 1916.

Experiments were carried out at the Agricultural Station of Purdue University in order to determine the actual cost of growing a Leghorn pullet from the chicken stage to laying age. The experiments also bore upon the number of eggs required to hatch a pullet, the percentage of pullets in a flock, the possible income from cockerels with their influence on the cost of the pullets, the cost of feed, fuel and labour, and the length of time necessary to grow a pullet.

Five experiments were carried out over a period of 165 to 175 days, from spring to autumn. The chicks were reared in 8ft. \times 8ft "A" shaped colony brooder houses, heated by gasoline. Clean land, plenty of green feed and abundant shade were available throughout the experiment.

Except for minor differences, the average ration used was as follows:

Grain: 2 lbs. sifted cracked corn (fine); 2 lbs. sifted cracked wheat; 2 lbs. steel-cut oats.

Mash: 2 lbs. bran; 2 lbs. shorts; 2 lbs. corn meal; 0.15 lbs. charcoal; 1 lb. meat scrap; 0.8 lb. ground dry bone.

Green feed, grit and skim milk: in abundance.

When the chicks reached about 0.7 lb. in weight, the grain was changed to cracked corn and whole wheat.

Prices of Feeds per 100 lbs.

Feed	Experiment No. 1	Experiments Nos. 2 and 3	Experiment No. 4	Experiment No. 5
Cracked corn (fine) . . .	\$ 1.80	\$ 1.60	\$ 1.60	\$ 2.00
Cracked corn.	1.80	1.60	1.60	1.70
Wheat.	1.50	1.45	1.45	1.60
Cracked wheat	3.00	2.15	1.65	3.25
Steel-cut oats	3.50	2.65	2.65	3.00
Bran	1.60	1.30	1.50	1.50
Shorts	1.70	1.50	1.60	1.70
Corn meal	1.90	1.45	1.80	1.70
Charcoal	2.30	2.30	2.30	1.60
Meat scraps	2.50	2.50	None fed	2.60
Skim milk	0.30	0.30	0.25	0.25
Bone	2.00	2.80	3.00	2.75
Grit	1.00	1.00	0.53	0.60

The results of the experiments are summarised by the writer as follows;

1) Based on four seasons' work and several thousand chicks hatched, it required 1.83 eggs set for every Leghorn chick hatched.

2) The cost of hatching these eggs was \$ 0.021 per chick, which, when added to the cost of eggs, increased the total cost of a chick when hatched to \$ 0.057.

3) Based on the first twelve weeks of life it took 5.69 pounds of grain and mash and 5.07 pounds of milk, costing \$ 0.1434, to feed a Leghorn chick. During the same time, it took 3.59 pounds of grain and mash and 3.41 pounds of milk, costing \$ 0.084, to produce one pound of gain.

4) When figuring cost of feed, fuel, labour and litter the whole cost of one pound of gain was \$ 0.154.

5) The average Leghorn pullet twenty-four weeks old and ready to lay, weighed 2.75 pounds.

6) The feed was by far the most expensive item in the cost of rearing chicks.

7) On the basis of 100 chicks hatched and a 17 per cent. mortality the percentage pullets and the percentage of cockerels were 40.1 and 42.9 respectively.

8) The time of hatching greatly influenced the rate of growth of chicks, price of broilers, net cost of growing, and weight of pullets at laying age. Early hatching paid best. Early cockerels were sold at a profit. May-hatched broilers sold at a loss.

9) The gross average cost of a pullet was \$ 0.434. This, less profits in cockerels, made the net cost \$ 0.381.

10) Mortality varied and influenced the final cost. The average mortality of 999 chicks was 17 per cent.

11) For every pullet reared it required the setting of 4.57 eggs.

12) Cockerels grew more rapidly than pullets.

572—The Use of Phototaxy in Selecting, from the Moment of their Birth, those Larvae of *Bombyx mori* most Resistant to the Disease "Flacherie".—ACQUA, C., in *Internazionale Seriche*, Year IV, No. 3, pp. 50-52. Rome, February 5, 1917.

In a previous paper (1) the author described many experiments carried out to determine the action of light on the movements of *Bombyx mori*. One of the most striking results obtained was that the newly-hatched larvae immediately turn to the source of light; this movement diminishes during the following days and disappears entirely at the end of the first stage. During the subsequent stages there is, on the contrary, an inverse, but less energetic movement, and the larvae tend to avoid light.

In the new experiments the long, wide glass and paper tubes, completely darkened except at one end, were replaced by half-darkened rooms into which the light entered from one side only though one half-open window. Sheets of paper were arranged on the table so as to form a rectangle a little more than 1 metre in length with the large axis parallel to the rays of light from the window. The eggs were placed on the extremity of the rectangle furthest from the window on a band parallel to the small side of the rectangle. This band was 3 cm. wide and 35 cm. long, and capable of holding about 15 gr. of eggs.

The newly-hatched larvae turned rapidly towards the window, crossing according to their specific capacity, one or many sheets. After 1 to 2 hours the movement had greatly increased, but, although they emerged practically at the same time, all the larvae did not show equal resistance or equal speed. One batch of larvae easily crossed the distance of about 1 metre, whereas others travelled shorter distances, while some hardly left the spot where they were born. The batches showing different reactions towards light were collected separately and bred separately. Excess of light diffused all round caused the worms to move in all directions. Even in these cases it was possible, by another method, to collect the batches showing different reactions. The first experiments, carried out in spring, aimed at determining whether the division of the larvae into 2 groups showing a different reaction corresponds to a difference in sex. The result was entirely negative, the proportion of males and females being equal in both groups.

During the summer and autumn, attempts were made to determine if the difference in the phototactic reaction of the larvae corresponds to different degrees of robustness, and consequently, different degrees of resistance to "flacherie". For this purpose it was necessary to use larvae susceptible to the disease. This was easily done by using eggs treated with hydrochloric acid immediately after they were laid, by the methods usually employed.

Eighteen experiments were carried out with pure and hybrid native chinese eggs. The different groups were bred under absolutely identical conditions so that various external conditions should have no influence on the eventual mortality.

(1) *Ser. B.* 1916, No. 328

The results of the experiments were constant: *the larvae which were most resistant to "flacherie" were those which, from the time of their birth had travelled furthest.* Original weakness by which some of the larvae were destined to die off was manifest much earlier in those groups which showed a limited phototaxic activity. In the case of an incomplete harvest, it was always the groups with the greatest phototaxic activity which gave the greatest number of cocoons. The results were always similar whether the experiments were carried out by the author himself or by breeders to whom batches were given without their knowing their phototaxic activity.

Only the last 4 experiments are described. These were carried out in late autumn with double-yellow larvae whose premature hatching was caused by treatment with hydrochloric acid; this was the second time this process was adopted in the year. In order to accentuate more greatly the difference between larvae with a weak or a strong phototaxic activity only those groups were reared which had showed the most marked differences, that is to say; 1) the larvae which had moved most rapidly more than 1 metre towards the source of light, 2) the larvae which had remained in the immediate proximity of the place where they were born.

The results are given below, *P* represents the larvae which remained very near their birthplace; *L* those which travelled furthest from it.

1st EXPERIMENT. — Hatched on September 27th., the two groups originally contained 1245 larvae each.

RESULTS: *Group P.* — Mortality, which was very great, commenced after the 3rd. moult; the group was completely destroyed shortly after the beginning of the 4th.

Group L. — In good condition to the end of the last stage; on November 4th., 1800 larvae reached their full growth on heather. 1166 good cocoons were obtained, only half of which gave moths, the chrysalides of the other half having died before being hatched.

2nd. EXPERIMENT. — Hatched on September 29th., the two groups originally contained 1420 larvae each.

RESULTS: *Group P.* — As in the preceding experiment; the group was completely destroyed between the 1st. and 2nd. days of the last stage.

Group L. — In good condition to the end. On November 26th., 1240 larvae were placed on heather; 800 good cocoons were obtained, but there was a great mortality before the chrysalides hatched.

3rd. EXPERIMENT. — Hatched on October 3rd.; the two groups originally contained 1250 larvae each.

RESULTS: *Group P.* — Mortality set in at the first stage; all the worms died before the 6th. moult.

Group L. — In good condition to the end. Placed on heather on November 4th. 900 good cocoons were obtained, but the majority of the chrysalides died before hatching.

4th. EXPERIMENT. — Hatched on October 5th., the two groups originally contained 860 larvae each.

RESULTS. — *Group P.* All the larvae died before the 3rd moult.

Group L. — In good condition to the end; all the larvae reached their full development on heather on November 26th., and spun their cocoons, but the majority of the chrysalides died before hatching.

These facts are perfectly clear and it seems that both rearers of silk-worms and egg producers might use them to their advantage.

The rearer could place the eggs, in the manner described above, on the shelves of the nursery in incubators with light coming from one side only. Those larvae which travel a distance of from 10 to 15 cm., for example, (this happens very quickly), will be collected, and the rest refused. It will then be certain that the worms most susceptible to "flacherie" will have been eliminated.

The author is testing a special incubator capable of automatically effecting this selection. By this method egg-producers will also be able to choose the larvae which show the greatest resistance to "flacherie".

If the selection is rigorously carried out the larvae chosen will be few and will perhaps not suffice for all the demands of a year, but they will form the basis for the breeding for the following year; the selection will then be repeated and so on.

573 - **The Consumption of Mulberry Leaves by Silkworms and the Influence of the Consumption on: 1) The Relation between Nervures and Parenchyma in the Leaves; 2) The Proportion of Fruits on the Branches.**—VIGIANI, D., in *H. Cultivator*, Year 63, No. 9, pp. 293-295, 2 fig. Casale Monferrato, March 30, 1917.

The principal qualities required of good mulberry varieties are: late budding; rapid and complete maturation of the wood; narrow pith; compact wood; consistent and thick leaves, not too watery, but having abundant parenchyma; nervures weakly developed; small production of fruit; leaves easily gathered, resistant to dessication, and can travel well.

Using his own researches as a basis, Prof. ARCANGELI has classified in decreasing order of value, and in relation to the abundance of parenchyma, the most common species and varieties of mulberry: 1) "Fiorentina"; 2) "Venosa" or "nervosa"; 3) "arancina"; 4) *Morus nigra*; 5) *Philippines* mulberry.

Table I, which gives the results of work done by M. GRAMIGNANI, shows the notable influence that the relation between the quantity of nervures and parenchyma has on the weight of leaves necessary to rear 1 ounce of eggs (30 gr., giving 40 000 silk-worms).

TABLE I. — *Results of the experiments made by M. Gramignani.*

Varieties of mulberry	100 kg. of leaves contain		Consumption of leaves per ounce of eggs	Weight of cocoons obtained from one ounce of eggs
	nervures	parenchyma		
Limoncina	19 kg	82 kg	1 600 kg	80 kg
Selvatica	12	87	800	86
Veronese	19	81	1 100	81
Cattaneo	31	69	1 200	79

These figures show that the varieties with fine, short nervures give an economy of 50 % of the amount of leaves necessary, besides giving a better yield of cocoons.

The writer made the same observation on rearings carried out at the "Vegni" Agricultural Institute under the auspices of the Minister for Agriculture. He further observed the great influence exercised by the quantity of fruit (left on the branches given to the larvae during the last 2 stages) on the feeding value of the different varieties.

Table II shows that, from one variety to another, the proportion of nervures and fruit is notably different. These characters should, therefore, be taken into consideration when choosing mulberry varieties for propagation.

TABLE II.
Proportions of nervures and fruits in various varieties of mulberry.

Varieties of mulberry	Kg. of nervures in 100 kg. of leaves	Kg. of fruits per 100 kg. of leaves
Sdvatico	26.510 kg	4.444 kg
Gentile	28.570	56.720
Limoncino	26.530	7.051
With red fruit,	26.373	80.430
Cattaneo	32.000	41.384
Arancina	33.890	—
Plangenti	28.070	89.350

FARM ENGINEERING.

574 - **Ploughing with a Tractor.** — RINGELMANN, MAX, in *Journal d'Agriculture pratique*. Vol. 29, No. 25, pp. 435-438, 4 fig.; Vol. 29, No. 6, pp. 103-106, 5 fig. Paris, Dec. 14, 1916, and March 22, 1917.

The organisation of a contracting business for ploughing by mechanical power forms a new field and requires special technical knowledge. The writer attempts to lay down the principles upon which the necessary technique should be built, in the understanding that it rests with practical experience to test the value of theory.

He considers: 1) the width to be given to the lands, using a tractor towing the majority of single breasted ploughs; 2) the width to be given to each headland in order to facilitate the work by reducing the time required for turning. With regard to the width of the lands the writer proposes the two following principles:

1) it is apparently advisable to make the lands as wide as possible; there is, however, a practical limit.

2) it is advisable to calculate closely the width of the lands, which should be a multiple of the gang width.

With regard to the working of the widest lands the writer gives, in the accompanying table, for a plough of which the gang-width is 1 metre, the distance to be travelled along one of the headlands of a half-ridge, the

distances along the two headlands, and for purposes of comparison, per half-ridge, the average distance which the plough has to travel along the two headlands on each journey.

Per half-ridge, for 1 headland			Per half-ridge for the 2 headlands	
Width of half-ridge	Number of gang-widths	Distance travelled along headland	Distance travelled	Average distance travelled per journey
5 metres	5	15 metres	30 metres	6 metres
10	10	55	110	11
15	15	120	240	16
20	20	210	420	21
25	25	325	650	26
30	30	465	930	31

It follows that for a land 60 metres wide, whatever its length, the distance travelled along the headlands would be about 2 kilometres which re-

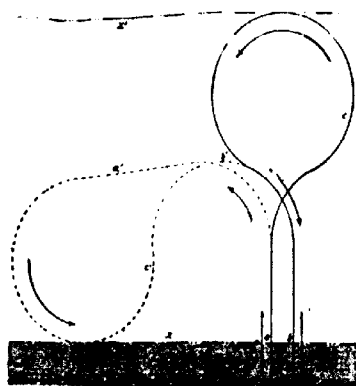


Fig. 1. -- Plan of a figure-of-eight turn.

presents, according to recent trials by the writer, a consumption of 2 to 3 litres of gasoline.

The last column of the table is the most significant, and it would not seem advisable to make the lands more than a score of metres wide; it is probable that about 30 metres is the maximum.

The soil of the headland becomes rough and this state increases with the number of journeys necessary to plough a half-ridge. As a result, team will find the headland difficult to work.

The width of the lands must be calculated closely, or else in ploughing

the last strip of each half-ridge the tractor will be obliged to go over ground already worked.

Further, in order to work well, it is advisable to leave, between the outer edge of the driving wheel and the side of the preceding furrow slice, a distance of at least 20 cms; on the other hand, in tractors with double drive, the distance between the outer edges of these wheels varies between

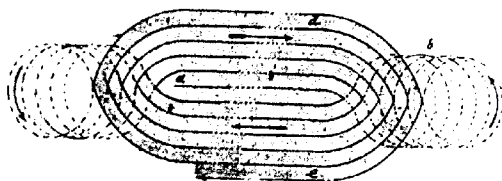


Fig. 2. — Plan of figure-of-eight ploughing.

1.4 and 2.5 metres, and another 40 cms. must be added for convenience in working; it results from this that the width covered by the last journey will not be sufficient and a strip will be left over which will require finishing with horses. This drawback can be surmounted in 2 ways: 1) by the use

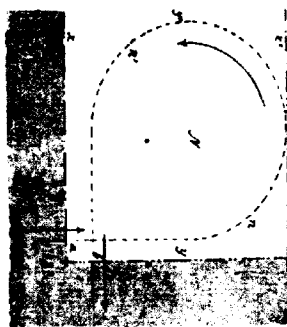


Fig. 3. — Plan of right-angle turn.

of a motor with single driving wheel; 2) by adopting in and out ploughing).

Tractors with single driving wheel show, in addition to certain mechanical advantages (simplification, suppression of the differential, etc.), that of being capable of working strips as little as 1 metre wide, as one of the guiding wheels can quite well pass over land already ploughed.

With in-and-out ploughing, the above mentioned difficulty is dimin-

ished if a tractor with double drive is employed, because there only remains a practically insignificant strip (relatively to the remainder of the field ploughed with the tractor) to be finished with horses, and it disappears entirely if a tractor with single driving wheel is employed.

With regard to the width to be given to the headland, it is, in the case of animal power, a function of the number of animals in the team. In the case of tractors, it is of the same order of magnitude, considering that the plough drawn by the machine could only be replaced by a team of 6 to 10 strong oxen requiring 10 to 17 metres of headland.

As the length of a tractor and plough covers 7 to 8 metres, one will require for a right angled turn a radius of at least 3.5 metres and the width of the headland will be at least 7.7 to 8 metres. In practice, in order to turn more easily without loss of time, headlands are kept at from 9 to 12 metres.

When the distance between two successive tracks is to be less than 7 to 8 metres, recourse must be had to the figure-of-eight turn, where the machine, on reaching *a* (fig. 1) at the edge *x* of the ploughed portion *L*, turns along the circle *c* in order to return to *b*, this point being as close as one like to the point *a*. The circle *c* being at least 7 metres in diameter, the width *xx'* of the headland *N* is at least 14 metres, and usually exceeds 15 metres. If it were necessary to reduce the width of the headland *N* (at least 8 metres), one would have to turn along the dotted line *a a' b b'*. In England and the United States, it is proposed to adopt the figure-of-eight method of ploughing (fig. 2), but this the writer does not recommend as one should avoid having to work while turning, at any rate on those portions in which the curve is cramped; finally this method means starting the work in mid field.

The *right-angled turn* (fig. 3) is also used when the tractor takes the place of a reaper and binder; one should have at one's disposal a space *N* of 8 to 10 metres.

To sum up, in the same way as with team ploughing, one should avoid turning too abruptly, and it is advisable to lighten the driver's work by making the headlands as wide as possible.

575 - **Tractor Plough Adjustments and Hitches.**—REED, C. O., in *Farm Implement*, No. Vol. XXXVIII, No. 9, pp. 26-27, 6 fig. Chicago, Illinois, March 1, 1917.

The true line of pull in a double drive tractor may be considered to pass midway between the two wheels as shown in fig. 1.

If the plough is not attached over this true line of pull side-draft will result in the motor, power will be lost, the gears will wear unevenly and the front wheels of the engine will tend to slide toward the ploughed ground. In addition, side-draft will result in the plough and the work will be badly done. The work is done under the best conditions when the resultant of the traction coincides with that of the resistance of the plough; this does not happen often, as the tractor is so much larger than the plough and side-drafting inevitably results.

The method of attachment considered by the writer as a good one is as follows:

As soon as the first furrow has been turned, place the engine as near as possible to the open furrow and carefully arrange the gang plough in its proper relation to the furrow. With a nail, scratch two marks on the draw bar of the engine, one to show the position of the true line of pull

Tractor plough hitches.

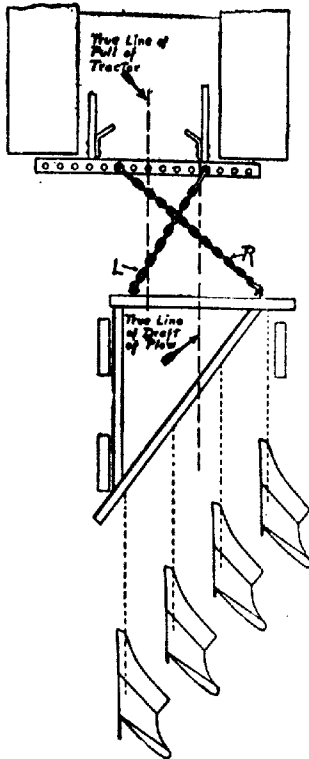


Fig. 1. — Hitch for tractor with a double drive-wheel.

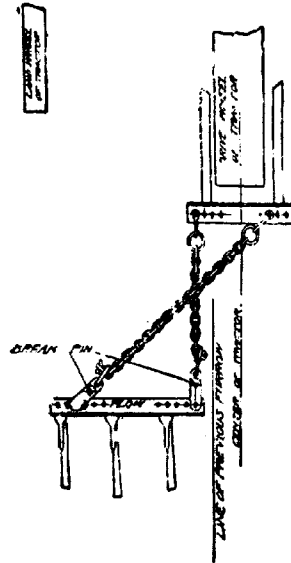


Fig. 2. — Hitch for tractor with a single drive-wheel.

of the tractor and the other to show where the true line of pull of the plough would cut the draw-bar. Then attach the chains in such a way that the cross in the chains is behind a point on the draw bar mid-way between the nail marks. If the cratch chain or bar hitch be used, bring the point of attachment to the draw-bar midway between the marks. If

much side-draft appears in the engine on starting work, the chains should be moved to the left on the draw-bar, while the chain *R* (fig. 1) should be lengthened. If there is much side-draft in the plough, the chains should be moved to the right on the draw-bar and the chain *L* (fig. 1) should be lengthened, thus applying the power nearer the true line of draught.

The same effect could be produced by shortening the chains *R* and *L* instead of lengthening them, but as most operators are inclined to hitch too close, it is advisable to suggest lengthening only, for side draft is usually more noticeable when short hitches are used. The shorter chain should be at least three and a half feet long. A couple of feet of extra chain will not make turning at the ends difficult if wide enough headlands are left. The long hitch has its disadvantages if the system is followed of ploughing round the field from the outside towards the centre.

The true line of pull of a single drive wheel tractor may be considered for all practical purposes to pass through the centre of the rim of the drive. Fig. 2 shows a cross chain hitch for a tractor of this type.

576 - **Spading-Machine of Wheel Barrow Type for Small Farms.**— *Scientific American*, Vol. CXVI, No. 8, p. 204, 1 fig. New York, February 24, 1917.

This spading machine was invented by a New Jersey farmer for use on small farms where labour is scarce.



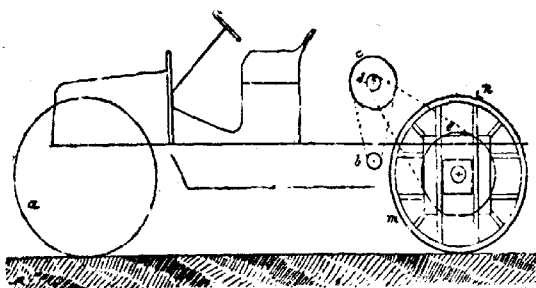
Spading machine: side view.

The machine is very light and can be handled like a wheel barrow. There are 2 spading forks, arranged to work alternately, and 2 sets of

springs both connected to the shanks of the spading forks, one set above, the other below the pivot. In this way they counterbalance each other. The springs are adjustable so that the spades can yield in one way or the other when they meet a hard obstacle. Each fork is driven by a piston and controlled by a small 8 HP internal combustion engine carried on a truck body with plough handles for guiding and controlling.

577 - **A Touring Car converted into a Tractor.**—RINGELMANN, MAX, in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 116, First Half-year, Vol. 127, No. 1, pp. 214-215, 1 fig. Paris, January-February, 1917.

Some time ago M. DE SALVERT, an engineer and agriculturist of Provins (Seine-et-Marne, France), converted an old touring car into a tractor,



Method of converting a motorcar into a tractor.

which he used on for some time on his Limoreau farm and then sent it to the trials at the Champagne farm where it was sold.

The accompanying figure shows how the car, a 18 HP touring PANHARD, type U2, chain-driven, 1907 model, was converted. The coach-body was removed, only two seats being left for the driver and another person. The wheels were replaced, the front wheels by 2 iron wheels *a* from an old binder, the back wheels by 2 iron wheels *m* built of sheet iron plates, with a tyre about 30 cms. wide. In order to reduce the speed while the motor works at the same rate, at each end of the driving shaft a gear wheel was placed so as to drive the wheel *e* fixed to the rear wheel through an intermediary transmission wheel *c*. As the diametres of the gear wheels required to reduce the speed to the required amount are known, as well as the speed and length of the chains, the right position of the axle *x* in relation to the driving shaft *b* and the wheel *m* is easily calculated. The wheels *c* *d* run on an axle fixed on brackets bolted on the frame and are lubricated by a cup.

The grip of the driving wheels on the soil is provided for by a receptacle placed on the rear of the frame which can be filled with weighty material. In working, a front and back wheel run in the furrow previously

opened. The tyres of the driving wheels are provided with a number of iron pieces π projecting about 8 cms. to afford a good grip.

With a double-brabant BAJAC plough with latticed mould-boards working at a depth of 25 cms. on a width of 37 cms., the tractive effort was found by M. DE SALVERT at the Champagne test to be 650 kg. equal to 70.2 kg. per square decimetre and corresponding to trials carried out by the writer with a similar plough in similar soil.

One hectare was ploughed in about 10 hours.

The tractor was used at Limoreau to pull 2 mowers having a knife beam 1.5 metres long; it was used with a harvester-binder with a knife beam 2.4 metres long. For carting, it pulled a cart with 350 sheafs of wheat in the field, while on the road it can pull a load of 4 tons.

According to M. DE SALVERT, the conversion of a touring car costs, at present, about 3 000 francs. The writer is of the opinion that, after the war, the conversion of old cars into tractors will be worthy of attention.

578 - **The Jullien Tool-holder for One-armed Men.** - RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 116, 1st. Half-year, Vol. 127, No. 1, pp. 16-25, 14 fig. Paris, January-February 1917.

An apparatus for the purpose of enabling one-armed men to use the various agricultural implements such as spades, forks, etc.

In the apparatus shown in figures 1 and 2, the upper part *A*, which has the function of giving mobility to the tool held by the tube *B* placed

JULLIEN Tool-holder for one-armed men.

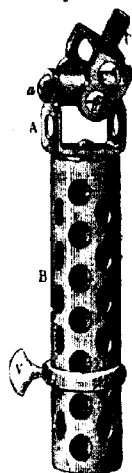


Fig. 1. — JULLIEN tool-holder.



Fig. 2. — JULLIEN tool-holder for a paralysed hand.

below, consists of two pivots *a* and *a'* which allow movement in any direction. The tube *B*, 95 mm. long and 36 mm. interior diameter, is so made as to take the shaft of a spade or other tool, made to fit exactly and held tight by a wingscrew *V*. The outer surface of the tube *B* is bored in various points so as to lighten the carrier.

For men with a paralysed hand, the JULLIEN apparatus has a slightly incurved iron plate so made that the fore-arm and hand rest on the plate, being held there with a leather sheath.

The apparatus can be fixed at the threaded part *C* by means of a lock nut (not shown in the figure) to the end of an artificial fore-arm or arm.

The first models weighed 375 gr., which was too light, causing doubts as to the strength of the universal joint, especially when the implement used acted by percussion, as is the case with picks, etc. For guiding the plough, the end of one of the stilts, suitably shaped, is fixed in the tube of the tool-carrier, while a spring takes up the vibrations.

The inventor has also designed for men having lost their fore-arm, a hammer-carrier with an anti-vibratory support which replaces the suppleness of the wrist and elbow and allows the one-armed man to hammer nails, etc. A rigid apparatus would tire the man very much and cause pain to the injured arm.

For planting out plants, M. JULLIEN has devised a simple spring-clip which is fixed at the end of an ordinary apparatus for a one-armed man.

579 - **The Width of Wagon Tyres Recommended for Loads of Varying Magnitude on Earth and Gravel Roads.** — MCCORMICK, B. E., in *United States Department of Agriculture, Circular No. 72*, 6 pp. Washington, February 12, 1917.

The recommendations in this circular are based on two factors: 1) the unit weight for width of tyre commonly used for road rollers, and 2) the results secured from a large series of traction tests conducted by the Office of Public Roads and Rural Engineering, extending over several years and made in widely scattered localities throughout the United States.

The following are the tyre widths recommended for wagons of different carrying capacities.

Type of wagon	Gross weight, loaded	Width of tyre
1 horse-wagon	2 000 lbs	2 inches
Light 2-horse wagon	3 500 "	2.5 "
Medium 2-horse wagon	4 500 "	3 "
Standard 2-horse wagon	6 800 "	4 "
Heavy 2-horse wagon	7 500 "	5 "

580 - A Humidifier for Lemon Curing Rooms. — SHAMEL, A. D., in *United States Department of Agriculture, Bulletin No. 494*, 11 pp., 7 fig. Washington, D. C., January 16, 1917.

A series of experiments having for their object the control of humidity in lemon curing rooms, lead the writer to invent a humidifier for maintaining conditions of uniform humidity (1) in such places. The principle of the apparatus is that air, driven by an electric fan, is charged with moisture by passing through a series of strips of cloth dipping at each end in two water pans, an upper and lower one. The water rises by capillarity on the cloths which pass through slots with edges raised above water level and made in the bottom of the upper pan. The water then dropped

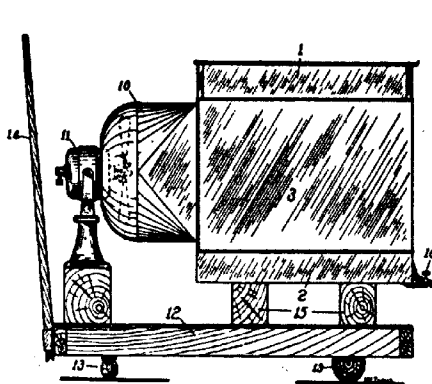


Fig. 1. — Side view.

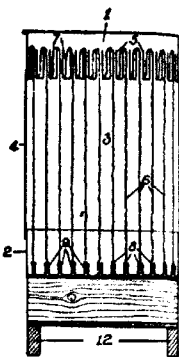


Fig. 2. — Transverse section

down through the suspended cloths, by gravity and capillarity combined, into the lower pan.

The apparatus, shown in side view in fig. 1, is composed of an upper pan 1 36 inches long, 24 wide and 6 deep, and a lower pan 2 of the same dimensions. The two pans are separated by a chamber 3 in which are the strips of cloth. The walls of the chamber, which is open at both ends, are 36 inches long and 26 inches high and connect the upper and lower pans.

The pans, sides and other metal parts are made of galvanised steel. The corners of the cloth chamber are strengthened by angle irons.

The bottom of the upper pan has a series of parallel, raised slots (fig. 2), 4 inches high and with their upper ends spread slightly so as to allow the easy passage of the strips of cloth 6. The upper edges of the strips are drawn through the raised slots and allowed to drop down into the water in the upper pan. The bottom edges of the cloths are bound with sheet metal strips 9, the bound edges being held in the lower pan by springs or clamps 8. The strips of cloth are 35 inches wide so as to fit the raised slots

(1) See B., January 1917, No. 78.

(Ed.).

and 36 inches long so as to extend from the lower pan through the raised slots and drop over into the water in the upper pan.

The walls of the chamber are prolonged as to form a circular hood **10** enclosing the electric fan **11**, which is 16 inches in diameter.

The humidifier, mounted on a truck **12** with 4 wheels **13**, can be moved about in any direction by means of the handle **14**. Supports **15** are placed under the humidifier and fan so as to raise them sufficiently to permit of a pail being placed under the spigot **16**.

When starting the apparatus, care should be taken to see that the edges of the cloths are submerged. Frequent readings of the humidity of the rooms should be taken, at first once every hour, by means of the sling psychrometer. The air temperature should also be taken. Readings must be made more often in variable weather.

The humidifier has been used successfully for two seasons in lemon curing rooms. The fruits have been cured better, as shown by better colour and firmness of the rind and greater juiciness of the lemons. The best conditions of humidity for curing lemons, as shown by these experiments, lies between 80 and 90 per cent. The apparatus has also been found to be very useful for improving the air conditions in living rooms of private houses.

The humidifier should not cost, apart from the electric fan, more than \$ 25.

For home use, a smaller type can be used.

581 - Review of Patents.

Tillage Machines and Implements.

Canada	174 114	Harrow.
	174 176	Tractor plough.
France	482 569	Cultivator.
	482 748	Trailer for Brabant plough for use by a one-legged man or an invalid (1).
United Kingdom	194 156	Plough.
United States	1 217 172 — 1 217 383 — 1 217 776 — 1 218 681 — 1 218 713 — 1 219 720	Cultivators.
	1 217 287	Implement-shifting means for tractors.
	1 217 839	Plough.
	1 217 864	Adjusting mechanism for ploughs.
	1 218 064	Disc attachment for ploughs.
	1 218 121	Motor-cultivator.
	1 218 338 — 1 219 902	Harrows.
	1 218 436 — 1 219 880	Weeders.
	1 218 541	Combined weeder and cultivator.
	1 218 581	Spring-tooth for cultivators.
	1 219 312	Foot-piece for cultivators.
	1 219 630	Draft appliance for ploughs.
	1 219 793	Soil-pulveriser.
	1 220 136	Device for raising a harrow or plough from the ground.

(1) See *B.*, March 1917, No. 270.

(Ed.).

Fertilisers and Manure Distributors.

Italy	156 065	New process for manufacturing mineral superphosphates.
United Kingdom	17 384	Process for enriching guano with ammonium sulphate produced by synthesis.
United States	1 217 863 — 1 218 361 — 1 218 866	Fertiliser distributors.
	1 219 823	Discharge tube for fertiliser distributors.

Drills and Sowing Machines, etc.

Canada	174 100	Seeder.
United States	1 217 780 — 1 219 361 — 1 219 644	Seeders.
	1 218 712	Seeder and harrow.
	1 218 773	Fertiliser attachment for seed drills.
	1 218 820	Check-row attachment for planters.
	1 219 996	Corn-planter shoe.
	1 220 014	Attachment for planters.

Control of Diseases and Pests of Plants.

France	482 513	Improvements in the larger types of spraying machine.
	482 543	Trap for nocturnal insects.
Italy	155 666	Sulphur dusting apparatus.
United States	1 218 953	Spraying and powder dusting apparatus.
	1 219 049	Sprayer.
	1 219 875	Weed-cutter.

Reapers, Mowers and Harvesting Machines.

Canada	173 573	Knife-bar for lawn-mower.
	173 581 — 174 095 — 174 172	Stokers.
	173 886	Harvester and thresher.
	173 916	Brake for header harvesters.
United Kingdom	17 406	Lawn-mowers.
	17 491	Mowing machines.
	104 071	Harvesting-machines.
	104 165	Lawn-mowers.
United States	1 217 332 — 1 219 150	Grain shockers.
	1 217 408	Cotton-harvesting machine.
	1 217 449	Mowing-machine.
	1 217 629	Harvester.
	1 217 906	Automotor harvesting machine.
	1 217 933	Grain-heading machine.
	1 218 011	Bean and pea harvester and separator.
	1 218 924 — 1 219 322	Knife-bars for mowers.
	1 219 327	Corn-gatherer.
	1 219 676	Stalk cutting machine.
	1 220 132	Clover harvester.

Machines for Lifting Root Crops.

United States	1 218 532 — 1 218 860	Beet-harvesting machine.
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Threshing and Winnowing Machines.

Canada	173 579	Grain separator.
	173 950	Threshing machine.
	174 118	Clover seed re-cleaning machine.
United Kingdom	17 650	Seed separator.
United States	1 217 209	Grain separator.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

Canada	174 093	Corn drier.
	174 108 — 174 172	Sheaf loaders.
United States	1 218 175	Hay-baler.
	1 218 448	Grain-grinding mill.
	1 219 020	Hay-loader.
	1 219 154	One-man hay-rack.

Forestry.

Canada	173 901	Timber felling machine.
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Steering and Traction of Agricultural Machinery.

Canada	173 921	Tractor.
United States	1 217 257	Implement-shifting means for tractors.
	1 217 284 — 1 217 293 — 1 218 388 — 1 219 444 — 1 219 030	Tractors.
	1 218 666	Transmission mechanism for tractors and the like.
	1 219 323	Tractor drive-wheel and mounting for same.

Feeding and Housing of Livestock.

Canada	173 632 — 173 727 — 173 507	Horseshoes.
United Kingdom	17 015	Process for recovery of albuminous products suitable for use as forage or manure from the waste water where fish, etc., is treated to obtain oil.
	103 550	Process for preparing food for animals from slaughter house offal, etc.
United States	1 219 352	Hog-oiler.

Aviculture.

Canada	173 965	Brooder.
	174 088	Poultry feeding and watering device.
United Kingdom	18 070	Method of packing eggs, etc.
	103 797	Troughs for animals.
	104 143	Poultry-feeders.
United States	1 219 114	Automatic poultry-feeder.

Industries depending on Plant Products.

Italy	156 133	Must separator.
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Dairyin.

Canada	173 750 — 173 875 — 173 876 — 173 877 — 173 878 — 173 879 — 173 880 — 173 881 — 173 882 — 174 090 — 174 147	Milk-ing machines.

174 033 Process for pasteurizing milk.

United Kingdom 17 336—17 777—17 778 Milking machines.

United States 1 218 125—1 218 529—1 218 446 Milking machines.

Farm Buildings.

Canada 173 630 Cattle stall.

173 640 Silo.

174 214 Roof for silos, etc.

582 — **Purifier for Rain-Water.** — GRANDIERE, L. M., in *La Vie agricole et rurale*, Year 7, No. 13, p. 227, 2 fig. Paris, March 31, 1917.

The simplicity, low price and easy construction of this new apparatus for purifying rain water make it of interest for all farms where rain water is used as drinking water.

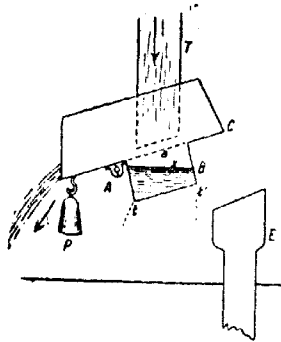
Purifier for rain water.

Fig. 1

Trough in normal position.

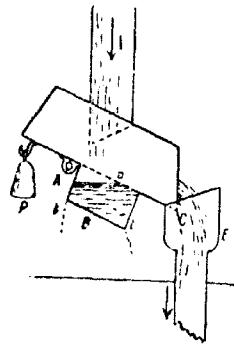


Fig. 2

Trough when tipped.

It consists of a galvanised iron trough *C*, of square section, 40 cms. long, 12 cms. wide and high, pivoted on an axle *A*. A weight *P*, attached at the end nearest to *A*, keeps the trough in a slanting position. A parallelepipedal box *B* is soldered on to *C* near to the axle *A*; it communicates with the trough by means of a number of holes *a* pierced in the bottom and has two very small holes *t* and *t'* for emptying. *T* is the pipe for the rain and *E* that leading into the cistern.

Normally, the trough is in the position shown in fig. 1. When there is rain, the water coming from the roof flows into the trough and escapes at the side *P*; but, as the water gradually filters through the holes *a* into the box *B*, at a certain moment the weight of water causes the trough to tip and the rain water, free from impurities, flows into the cistern by *E* (fig. 2).

The axle *A* is of iron, 10 to 20 mm. in diameter, and firmly fixed in the

all. Two pins prevent the trough from moving either near to the wall or slipping off the axle. The tipping action should be easy.

The box *B* should contain about a litre; the number of holes *a* should be in inverse proportion to the area of the roof, for, the larger the roof, the longer it takes to wash it clean. Roughly speaking, the roof will be efficiently clean when 1 to 2.5 mm. of rain have fallen, which is equal to from 1 to 1.5 litres per square meter.

The distance of the axle *A* from the weight *P* will equal $\frac{1}{3}$ or $\frac{1}{4}$ the distance from *A* to *C*. The weight *P* should be such that the box, filled with water up to the level *x*, should tip easily and that the box being empty or nearly so, it can return the apparatus to its original position, which takes place when the small holes *t* and *t'* have allowed the water to escape slowly.

After a fall of rain, the holes *a*, *t* and *t'* should be examined to see that they are not stopped up.

RURAL ECONOMICS.

83 - **Methods and Cost of Growing Beef Cattle in the Corn Belt States.** — CORRON, J. S., COOPER, MORTON O., WARD, W. F. and RAY, S. H., in *U. S. Department of Agriculture, Office of the Secretary, Report No. 111*, pp. 1-63, Washington, July 1, 1916.

This study represents Part III of an investigation into the production and consumption of meat organised by the Secretary of Agriculture (1). The data were collected from 595 farms representative of the agricultural situation in the Corn Belt, in the following states: Illinois, Iowa, Missouri, South Dakota, Nebraska, Kansas, Minnesota and Indiana. Cattle-breeding is the most important branch of agriculture in this district; in Minnesota, 29 % of the total farm area is pasture, and in Indiana 65 %.

Table I summarises the data collected in each state concerning the size of the farms, their division into pasture, corn, small grain and hay, and their average value per acre.

The chief object of the investigation was to determine as accurately as possible the cost of producing beef animals. With this end in view the records were divided into 6 groups based on the 6 distinct practices followed in general by the farmers.

GROUP I (Beef). — *Farms where all the cows are kept strictly for beef (not including farms producing baby beef). On a number of these farms enough milk was taken from 2 of 3 of the best milkers to supply the family with milk and butter. In such instances the milk and butter credits have been ignored as it was found that the value of the extra labour in milking and caring for the calf, and of the extra grain given, usually offsets the value of these milk products.*

GROUP II (Baby Beef). — *Farms on which the breeding herds are*

(1) See *B.* March 1917, No. 286.

(Ed.).

maintained for the production of high-grade calves, which are fattened on the same farm and sold at from 12 to 18 months of age as baby beef.

GROUP III (Dual purpose). — *Farms on which all the cows are milked, and either cream or butter sold, the calves being weaned at birth and raised on skim milk.*

GROUP IV (Mixed). — *Farms on which the best cows are milked, their calves being weaned at birth and fed skim milk. The calves from the other cows are allowed to run with their dams as in the beef group.*

GROUP V (Partially milked). — *Farms on which the calves are not weaned, but on which a part of the milk is drawn from the cow, the calf taking the remainder. There are a number of variations of this practice. One of these is to allow the calves to run with their dams during the day, but to keep them in a separate inclosure at night, the cows being milked in the morning. Another common practice is to keep the calves separate and allow them to take the bulk of the milk twice daily, the remainder being taken for household and market purposes.*

GROUP VI (Double nursing). — *Farms where some of the cows are milked and their calves given to other cows, the latter raising two calves each.*

TABLE I. — *The Average Size and Value of Farms Visited and the Percentage of Each in Pasture, Corn, Small Grain and Hay, by States*

State	No. of farms	Average size of farms		Area in pasture		Area in corn		Area in small grain		Area in hay		Value of land
		acres	%	acres	%	acres	%	acres	%	acres	%	
Indiana (1914) . . .	23	294		191	65	43	15	16	5	25	9	\$40
Illinois (1914) . . .	21	204		158	54	60	29	32	11	38	13	120
Minnesota (1914-15) . .	60	357		104	29	85	24	66	18	54	14	120
Iowa (1914-15) . . .	219	301		93	31	83	29	54	18	38	13	175
Missouri (1914-15) . .	78	356		479	50	53	15	36	10	71	20	80
South Dakota (1914) . .	14	511		180	35	146	29	90	18	75	15	60
Nebraska (1914-15) . .	66	380		116	31	105	28	74	19	53	14	140
Kansas (1914-15) . . .	114	566		326	57	79	15	62	11	69	12	80

It may be seen that, in all these groups, animal production is based on the breeding herd, which remains almost constant. Table II shows the average importance of breeding cows in the 6 groups.

The cost of beef production was estimated by the following method: First of all the annual gross cost of maintaining each breeding cow and each bull was determined. The net profit was then estimated, including milk and manure, but excluding the calves. Next the percentage of baby beef in proportion to the number of cows and bulls was calculated. The net cost of the cows and bulls was divided in proportion to these percent

TABLE II. — *The Size of the Herds in Each of the Different Groups.*

Group	Number of farms	Cows		Bulls	
		Total number	Average number	Total number	Average number
.....	230	7 246	31.50	255.5	1.11
.....	66	2 281	34.56	81	1.23
.....	110	1 493	12.75	103.25	0.94
.....	102	2 394	23.47	101	0.99
.....	65	929	14.29	60.5	0.92
.....	22	381	17.32	20	0.91
General average.	595	14 834	24.85	651.25	1.04

TABLE III. — *Average Gross Cost of keeping a Breeding Cow in the 6 Groups, and Net Cost.*

Number of farms	Number of cows	Average cost per cow.										Total gross cost	Total net cost including milk, butter and manure (excluding calves)
		Summer	Winter	Entire year	Labour	Equipment	Interest	Risk	Taxes	Insurance (20% of the farms)	Veterinary		
		\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
230	7 246	8.20	16.49	24.69	3.88	1.75	3.83	.43	.34	.06	.14	35.12	30.33
66	2 281	9.11	17.19	26.30	3.11	2.25	4.16	.43	.31	.10	.11	36.17	31.38
110	1 493	7.90	24.15	32.05	15.23	3.32	3.60	.43	.31	.07	.13	35.14	6.07
102	2 394	7.43	20.30	27.73	9.03	2.57	3.90	.43	.32	.07	.10	43.95	19.23
65	929	8.08	17.97	26.05	9.84	2.23	3.59	.43	.40	.07	.14	41.75	21.32
22	381	8.50	20.30	28.80	9.80	3.01	3.82	.43	.33	.05	.17	46.50	13.24

ages. The average cost of the calves until weaning time on the different groups of farms was thus obtained. In determining the cost of production for one year the following factors were taken into consideration: — food, labour, equipment, interest, risk, taxes, insurance and veterinary expenses. The costs thus obtained were compared with the inventory or sale values.

Table III gives data concerning the average gross cost of keeping cows in the 6 different groups, and the net and relative cost, including milk and manure, but excluding calves. In a similar way the cost of bulls was determined, and the cost of calves up to one year by the method described above.

Table IV summarises the results of these calculations as compared with the cost of production. In considering the records of the two years

TABLE IV. Summary Table Showing for the 6 Groups the Various Factors that make up the cost of Producing a Yearling

Item	Group I	Group II	Group III	Group IV	Group V	Group VI
Number of farms						
Average number of cows per farm	240*	66	110	102	65	22
	31.50	11.56	12.75	23.47	14.29	17.32
<i>Cost of maintaining the breeding herd:</i>						
Gross cost of maintaining a cow	\$15.14	\$16.77	\$55.14	\$13.95	\$42.75	\$46.50
Credits other than cow	4.70	5.39	49.97	24.72	21.43	33.26
Net cost of maintaining a cow	10.35	11.38	6.07	19.23	21.32	13.24
Net cost of maintaining a bull	12.27	53.26	37.51	46.79	34.14	40.53
<i>(Calf crop):</i>						
Percentage of cows raising calves to weaning time	84.0	90.7	83.9	87.5	90.1	92.1
Number of calves per bull	20.9	25.3	19.7	18.5	12.6	15.0
<i>Cost of raising a calf to weaning time:</i>						
Cow charge	35.47	34.50	7.34	22.29	23.71	14.53
Bull charge	2.46	2.29	4.02	2.01	3.55	3.02
Feed, including pasture	0.01	—	9.35	4.48	0.02	0.26
Labour	—	—	2.56	1.11	—	0.01
Total cost at weaning time	37.74	36.79	23.27	30.79	27.08	17.82
<i>Cost of raising a yearling:</i>						
Number of farms	190	67	99	96	57	22
Average number of calves per farm	24.43	30.20	10.57	18.46	11.16	14.23
Cost at weaning time	38.49	37.01	23.64	30.01	26.39	17.82
Winter feed cost	12.12	35.02	9.93	12.01	12.21	10.24
Other charges	4.02	6.02	4.22	4.22	4.60	3.86
Gross cost	54.63	78.05	37.79	46.24	43.20	31.92
Credits (finances)	1.60	1.53	1.89	1.34	1.54	1.07
Net cost at 1 year	53.03	76.52	35.90	44.90	41.66	30.85

1914-1915, it should be noted that the rather low average is due to the unsatisfactory results of the first year, caused by drought. The data obtained indicate that the keeping of cattle for beef purposes alone is adapted to the more extensive types of farming, while the keeping of cattle primarily for beef purposes, but where an income is also obtained from milk products, is better adapted to the more intensive types of farming. When estimating the profits obtained by raising calves on corn belt farms the following facts must be taken into consideration: 1) Good returns have been obtained for a large quantity of roughage which would otherwise have been wasted; 2) a home market has been provided for saleable crops; 3) on many farms a large acreage suitable to pasture only has been utilised; 4) profitable employment is provided for a season of the year when labour otherwise might be idle; 5) a return is obtained for capital invested in equipment which, in many instances, were it not utilised by live stock, would return nothing; 6) the farmer makes at least 6% interest on the money he has invested in the cattle business.

It should be noted that the greatest profits were yielded by Group VI, the double-nursing group. Although this system is adopted by a small number of breeders only and only 22 records were procured, it gave the lowest cost of production both for calves at the time of weaning and for yearlings. This result is largely due to the milk credits, which were obtained without extra labour other than milking. It is also due to a larger percentage of calves produced by the cows, and to a larger proportion of the records being taken in the more favourable year of 1915.

584 - **The Economies of Live Stock Production in the Far Western Range States, U. S. A.** — See No. 590 of this Bulletin.

AGRICULTURAL INDUSTRIES.

585 **Fermentation Tests of Tea Leaves, in Java.** — BOSCH, K. A. R. and BRZEZOWSKY, A., in *Meldelingen van het Instituut voor Thee*, No. XLVII, 1914, 10 figs. + 1 pl. Buitenzorg, 1915.

The writers wished to clear up the controversial problems regarding the character of the fermentation of the leaves of the tea plant, necessary to obtain black tea.

Up to the present the fermentation was either attributed to the oxidising action of peroxidases on certain substances in the leaves, or to the development of certain microorganisms, particularly yeasts.

The writer found that the microorganisms found normally on freshly gathered tea leaves were species of Hyphomycetes belonging to the genera *Aspergillus*, *Penicillium*, *Mucor* and *Pematiom* — 1 species of yeast, — 3 species of bacteria, including a *Micrococcus*.

To ascertain the influences of these organisms on the fermentation, a method was first tried for sterilising the leaves without reducing them to such a state that fermentation was no longer possible. For this end, the

leaves were washed in hydrogen peroxide, chloroform and mercuric chloride. To control the results, the varying temperatures of an untreated and fermenting heap of leaves were taken, when it was found that the temperature rose to a maximum of about 35° C., after which it gradually decreased.

On examining the organisms on leaves sampled at various stages of the fermentation, it was found that, before the temperature attains its maximum, the yeasts preponderate amongst the microorganisms; at the same time the samples tested for taste, aroma and other qualities gave satisfactory results. But as soon as the temperature begins to drop, the bacteria begin to preponderate over the yeasts, and the quality of the tea becomes inferior. At a temperature still further from the maximum, the Hyphomycetes *Penicillium* and *Mucor* develop in mass and the tea made from these leaves has a disagreeable taste.

On repeating the experiment with the sterilised leaves, the writers first found a rise in temperature towards the maximum analogous to that found with unsterilised, fermenting leaves, but afterwards the temperature followed another curve and sometimes reached, after falling, a new maximum. The leaves either remained sterile or harboured microorganisms after a certain time. The taste of the tea made from a sample taken after the first maximum was unpleasant in every case.

Whilst admitting that their work has afforded no satisfactory explanation of all the problems of the fermentation, the writers have concluded that it is due to a change in composition of the leaf independent of the action of the microorganisms on the leaves (Dr STRAUB had already come to the same conclusion from his work published in *Mededeelingen van het Proefstation voor Thee*, No. 18). The writers continued their researches by studying the formation of carbon dioxide during the fermentation and have found it both in leaves previously sterilised and in leaves fermenting in the ordinary way. They conclude that the microorganisms have nothing to do with the formation of carbon dioxide.

These researches demonstrate the importance of a plentiful supply of oxygen for fermenting leaves; it is, therefore, advisable to ventilate well the places where the leaves are stored.

It was also found that the critical temperature for a regular and uninterrupted fermentation of tea leaves lies between 43° and 43.5° C.; consequently tea cannot ferment in an atmosphere of steam at 100° C., contrarily to what Mr. H. JENSEN had found for tobacco.

In any case, the microorganisms are of very slight or no importance in tea fermentation, as is shown by these researches.

586 - "Leblebii", a Food Made from the Chick Pea (*Cicer arletinum*), in the Eastern Balkans. — ZILATOFF, A. (Communication from the Laboratory of the University of Sophia), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 33, No. 3, pp. 107-112, Münster i. W., February 1, 1917.

"Leblebii", chiefly made in Bulgaria and Turkey, is much appreciated as a food and for making pastry ("chaiva", "rachat-lukum", "cheker", etc.), which is also used in popular remedies. Roasted "leblebii" is also

TABLE I. *Comparative Chemical Composition of the chick pea and "leblebi".*

Substance analysed	Water	Fatty matter	Crude protein	Pure protein	Starch	Crude cellulose	Ash	P ₂ O ₅
Chick pea.	No. 1 10.00%	4.79%	23.22%	21.16%	52.61%	3.40%	2.85%	0.89%
	No. 2 10.41	4.93	23.03	20.82	52.17	3.60	2.60	0.84
Leblebi.	No. 1 5.70	5.10	24.84	—	55.94	2.41	2.70	0.95
	No. 2 5.43	5.31	24.68	—	55.70	2.23	2.41	0.91

TABLE II. — *Physical Constants of the fatty matter extracted from the chick pea and "leblebi".*

Constants	Fatty matter extracted	
	from the chick pea	from "leblebi"
Specific gravity (15° C)	0.9364	0.9283
Refractive index at 25° C	74	72.5
Saponification index	240	190.2
Acid index	0.7	2.3
Ether index	230.3	193.9
REICHERT-MEISEL number	4.3	3.7
POLENSKE number	1.6	5.2
HOFMEIER number	0.007	89.19
Iodine index	120	120
Non saponifiable substances	0.40	0.48
Liquifaction point of fatty acids	25° C	25.4° C
Iodine index of fatty acids	140	130
Phosphatides (like lecithin)	2.12 %	12.0 %

TABLE III. — *Composition of the ash of "leblebi".*

Iron oxide	2.12 %	P ₂ O ₅	34.16 % (WOY method)
			36.48 (NEYMANN method)
Lime	9.09		
Magnesium	18.80	SO ₃	3.99
Potassium	26.01	SiO ₂	0.40
Sodium	3.10	Chlorine	1.08

used by the poor people as a substitute for coffee, and, commercially, for adulterating ground coffee.

PREPARATION. — The chick peas are first separated into the different sizes by screening through leather or gut riddles, then the various grades are roasted separately, for about half an hour, on special open ovens, the chick peas being constantly stirred with a stick; the roasting is considered suffi-

cient when the peas are tender. They are then placed in sacks where they are left, at the ordinary temperature, until they have returned to their original state of hardness, which requires from 24 to 48 hours. Then a second roasting, or "naotlama" is carried out, after which the product is stored for at least a month, when they are packed, in quantities of 30 to 40 kilos, in wooden tubs containing sufficient non-calcareous river water just to swell the peas and prevent their looking dry on the surface. The more time that elapses between the first and second roasting, the less water the peas absorb, the resulting quality of the "leblebii" being improved.

The swollen peas are then roasted a third time, in smaller quantities than before, but so arranged that the roasting is all done in 6 hours. The peas should be stirred continuously and their appearance noted: they turn a yellow-grey colour and the tegument becomes brittle, which makes it easy to remove and taste the product at intervals until the required taste and consistency are obtained. Then the commercial "leblebii" is obtained ready for sale. Before the war, it cost from 60 to 80 centimes the kilo.

CHEMICAL COMPOSITION. - Table I, which gives the composition of both "leblebii" and the chick pea, shows that the roasting has decreased the water content and the percentage of crude cellulose in the former.

Table II, which gives the physical and chemical properties of the fatty matter extracted by ether from the chick pea, and "leblebii", shows that the change from the first to the second has decreased the iodine index and increased the acid index. The increase in the content of phosphatides (lecithin) is also characteristic.

The writer also determined the changes undergone by the carbohydrates in the preparation of "leblebii". Analyses made by the GERBER & RADENHAUSEN method showed that 20 % of the starch of the chick pea is changed into soluble dextrin.

Table III shows the composition of the ash of "leblebii". While the chick pea is very hard and difficult to chew, "leblebii" presents no such difficulty; it has a sweetish taste and differs from the nuts used as food in Europe by its lower fat content; it is probably more digestible than the nuts. "Leblebii" is very useful in feeding children over 6 months old, especially when they have intestinal troubles.

587 - **Changes in Fresh Beef During Cold Storage Above Freezing.** - HAGLAND, R. McBRIDE, CH. N., and POWICK, W. C., in *U. S. Department of Agriculture, Bulletin* 431 (Professional Paper), pp. 1-100. Washington, February 13, 1917.

There are two general methods of handling fresh beef in cold storage: 1) storage at temperatures above freezing, usually between 32° and 38° F., and 2) storage at temperatures below freezing, usually between 8° and 12° F. According to HOLMES (1913), 3.1 per cent. of the beef slaughtered commercially in the United States in 1900 was placed in cold storage at temperatures below freezing (frozen beef); 96.9 per cent was stored at temperatures above freezing (chilled beef).

This discussion only concerns chilled beef, and the methods by which it is handled in the larger meat-packing establishments of the United States.

It was undertaken with the following objects in view : 1) To study the changes which take place in fresh beef stored at temperatures above freezing, with special reference to the effect of such changes upon the wholesomeness of the product ; 2) to determine the causes of the changes which take place in fresh beef held in cold storage under the above conditions ; 3) to determine the length of time that fresh beef can be held in cold storage at temperatures above freezing and remain in wholesome condition, with special reference to the effect of various factors upon the length of the storage period.

For the purpose of studying the problems outlined above, three distinct lines of investigation were planned : 1) autolysis experiments with fresh beef ; 2) cold storage experiments with fresh beef ; 3) a study of the factors affecting the length of time that fresh beef can be carried in cold storage.

The changes which ordinarily take place in fresh beef and in other meats as well, during cold storage at temperatures above freezing, may be due to one or more causes : 1) enzymes occurring naturally in the meats, 2) bacteria, and 3) chemical and physical agencies.

The action of the first of these agencies is probably less well understood than is that of the two others, and seemed to call for special investigation.

Results of Autolysis Experiments. — The results of the autolysis (1) experiments reported in this paper may be summarised as follows : Physical changes in the samples of muscular tissue were not marked, even at the conclusion of the experiment and consisted chiefly of a slight softening of the tissues, and exudation of meat juice, and a change in colour of the meat.

Incubated samples developed a characteristic, rather pleasant odour similar to that of roast beef the odour becoming more pronounced as the period of incubation progressed. A sample which had been incubated 103 days did not prove to be a palatable food for human consumption.

Total soluble extract or total solids showed a decrease early in the experiment and later an increase, the total increase amounting to 8.77 per cent. of the amount present in the fresh material. Ash of extract showed appreciable, but not regular, increases, which correspond roughly with similar increases in total soluble phosphorus.

The acidity of the samples showed appreciable increases, particularly toward the close of the experiment.

The changes which took place in the nitrogenous compounds consisted in general in an increase in total soluble nitrogen and in a conversion of the higher forms of soluble nitrogenous compounds into simpler combinations. Coagulable nitrogen showed a marked decrease, more than 50 per cent. of which took place during the first week of the experiment. The total decrease amounted to approximately 80 per cent. of the amount present in the fresh material. Non-coagulable nitrogen increased fairly

(1) The discovery of autolysis is generally accredited to SALKOWSKI (1891) who called the process "autodigestion".

regularly during the course of the experiment, the total increase amounting to 173.8 per cent. Proteose nitrogen increased rapidly early in the experiment and the quantity then remained practically stationary during the remainder of the incubation period. Amino-nitrogen showed greater actual and relative changes than any other nitrogenous constituent, this constituent representing in large degree an accumulation of the end-products of proteolysis. The total increase in amino-nitrogen amounted to 740 per cent and nearly one-fourth of the total nitrogen was in the amino form at the end of the experiment.

Phosphorus compounds showed changes which consisted chiefly in appreciable increase in total soluble phosphorus and in soluble inorganic phosphorus, and in corresponding decreases in insoluble and insoluble organic phosphorus. Insoluble phosphorus decreased rapidly early in the experiment and more slowly and fairly regularly during the remainder of the period, the total decrease amounting to 91.29 per cent. of the amount present in the fresh material as calculated from the ratios of insoluble total phosphorus. Total soluble phosphorus showed increases corresponding to the decreases in insoluble phosphorus, the total increase amounting to 23.05 per cent, as calculated from the ratios of total soluble phosphorus to total phosphorus. Soluble inorganic phosphorus increased rapidly early in the experiment, and more slowly towards the close, the total increase amounting to 65.27 per cent., as calculated from the distribution figures. Soluble organic phosphorus showed decreases corresponding to the increases in soluble inorganic phosphorus, the total decrease amounting to 75.95 per cent., as calculated from the organic phosphorus ratios.

There was no development of free hydrogen sulphide during the course of the experiment.

Results of cold-storage experiments with fresh beef.

The chemical changes which took place in the muscular tissue of beef in cold storage at temperatures above freezing for periods ranging from 14 to 177 days, consisted chiefly in increases in acidity; in proteose non-coagulable, amino and ammoniacal nitrogen; and in soluble inorganic phosphorus; while decreases occurred in coagulable nitrogen and in soluble organic phosphorus. On the whole these changes were of a progressive nature.

The chemical changes that took place in the fatty tissues of the beef consisted chiefly in marked increases in the acidity of the kidney, and external fats.

On the whole the chemical changes which took place in the muscular tissue of the beef during storage were similar in nature to, but less in extent, than those that were caused by enzymatic action, when lean beef was autolysed under aseptic conditions for periods ranging from 7 to 100 days.

The chemical changes which took place in the muscular tissue of the beef during storage were without appreciable effect either upon the nutritive value or the wholesomeness of the edible portions of the product;

but the changes which took place in the kidney fat and external fatty tissue after the longer periods of storage rendered them unsuitable for human consumption.

The bacteria and moulds which grew on the surface of the cold-stored meats did not penetrate the muscular tissue to any great depth. The increased tenderness noticed in the cold-stored meats could not be attributed to bacterial action; and no noticeable change in the histological structure of the muscle fibres was noticed after 11 weeks of storage.

The chemical changes which took place in the muscular tissues of the beef during storage may be regarded as largely due to enzyme action.

The principal effect of storage upon the organoleptic properties of the beef was a marked increase in tenderness of the meat. This change did not appear to progress appreciably after the beef had been held in storage for from two to four weeks. While the flavour also changed, individuals would probably not agree as to whether the change was an improvement or a deterioration.

Beef was held in cold storage at temperatures above freezing in an experimental cooler for as long as 177 days, whereas it was possible to hold beef in storage in a cooler in a modern packing-house for only 55 days. The shorter storage period in the second instance was due to the much higher humidity of the packing-house cooler, as compared with the experimental cooler.

The length of time that fresh beef can be held in cold storage at temperatures above freezing and remain in wholesome condition, is dependent upon a number of factors, among which the temperature and humidity of the storage room and the character of the beef are the most important.

588 - *Investigations into the Changes undergone by Eggs.* -- LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 11, pp. 320-329. Paris, March 21, 1917.

This paper is a summary of a report presented to the Public Health Department at the request of the Prefect of Police of the Seine Department. It contains the results of experiments made in collaboration with M. HUSSON, tutor at the National Agricultural School of Grignon.

In order to measure the extent of the change, account was taken of: 1) the amount of albuminoid peptonised by the bacteria, which, consequently, is not coagulated by heat, or even precipitated by alcohol of a given concentration; 2) the amount of ammoniacal nitrogen produced by bacterial fermentation.

Eggs may be attacked by bacteria (bacilli and cocci) (1) and by moulds.

Among the bacteria may be mentioned: *Bacterium coli*, even the typhoid and paratyphoid bacilli; *B. subtilis*, *B. pyocyaneus*, *B. liquefaciens fluorescens* and *B. liq. non fluorescens*; *Pasteurella*, *Sarcinae*; *Bacterium termo*, *Bacterium putridum* Flügge; cocci, including *prodigiosus*, *Staphylococcus albus* and *aureus*, etc.

(1) See also: B. 1916, Nos. 334 and 1025.

Among the rarer fungi are : *Penicillium glaucum* and *Sterigmatocystis*.

In experiments on 2510 eggs from 65 hens, MR. CALDWELL, Director of the Rhode Island Agricultural Station, found bacteria in only 228 (8.8%). In each case the yolk only was attacked, the white being immune. It may, therefore, be assumed that an egg which contains bacteria, has been infected within the ovary, where the yolk forms, rather than in the oviduct, where it is covered with albumin.

Since all eggs go bad in due course, there can be no doubt that the bacteria can penetrate the shell and its membranes. Infection is not very rapid, especially in the white of the egg, as the mucous liquids do not form a good medium for the growth of bacteria. In time the white, and more particularly the yellow, liquefy during peptonisation under the influence of the proteolytic diastases secreted by the bacteria; when held to the light the yellow may be seen, first floating on the white, then mixing with it.

The author followed this progressive change by the estimation of the ammoniacal nitrogen in the presence of magnesia. At the beginning there was an average of 0.010 gr. of ammoniacal nitrogen per 100 gr. of eggs. After 6 weeks' incubation at 28 to 30° the percentage was 0.021, or even 0.024 %. The same figures were obtained for both fertile and unfertile eggs.

Hard eggs change more rapidly than fresh eggs. In order to study this phenomenon the ammoniacal nitrogen was estimated in a batch of new-laid eggs, half of which were left raw and the other half boiled for a quarter of an hour. These eggs were then kept at a temperature of from 28 to 30° for equal lengths of time, the last being of 50 days' duration. Samples were taken from time to time. Whereas the ammoniacal nitrogen content of raw eggs was 0.024 gr., that of boiled eggs was 0.107 gr., that is to say, 4 times as great. The peptonised nitric matter rose from 0.66 to 0.91 % in the raw eggs, and to 1.36 % in the boiled eggs.

The more rapid change of boiled eggs as compared with that of raw eggs is due to the following causes : 1) boiling renders the shell membranes more permeable to gas, fluids and bacteria ; 2) boiled white of egg is no longer a viscous mass, but is composed of particles of coagulated albumin which form a favourable medium for the growth of microorganisms. The estimation of the ammonia proved that, whereas, in raw eggs of different ages, the yellow contains more ammonia than the white, the contrary is true of boiled eggs, in which the ammonia in the white finally exceeds that in the yolk in the ratio of 150 to 100.

Moulds may enter the egg during its passage through the oviduct, and, though larger than bacteria, they may penetrate the shell. This has been proved experimentally. Within the egg, the mycelium forms so-called "damp spots" (because they appear when the egg is left on damp straw). The fungi which cause the stains form a mass of mycelium and spores. The base of the mycelium is fixed either to the inner shell membrane or between two membranes, but not on the shell. These mycelium are either pale yellow, greenish black or a fine pink. The yolk often adheres, not to the

shell, but to the mycelium, which fastens on to it and displaces it. In hard-boiled eggs only the yolk seems to be displaced as the viscous mass of the mycelium is coagulated.

The estimation of the ammoniacal nitrogen throws little light on the change produced by the stain, because moulds have but a weak power of forming peptone or ammonia.

The moulds which form the stains are identical with those found on fruit and cheese. The bacteria may prove harmful, and eggs attacked by them should not on any account be used for human consumption.

589 - **The Maintenance of Atmospheric Humidity in Citrus Storage Rooms.**—
See No. 580 of this Bulletin.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

590 - Root Diseases Due to *Rosellinia* sp. in the Lesser Antilles. — NOWELL, W. in *West Indian Bulletin*, Vol. XVI, No. 1, pp. 31-71, Fig. 1-12, Bridgetown, Barbados, 1916.

Several species of the genus *Rosellinia* give rise to a well defined type of root disease in numerous countries of the world, both temperate and tropical. The fungus kills cultivated trees and shrubs, and often infests the soil and destroys practically all vegetation with which it comes into contact.

In the Lesser Antilles, *Rosellinia* diseases occur in Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, and Grenada; they are unknown in the remaining islands of the group which have drier climates.

The range of hosts is exceedingly large including practically all the important cultivated and semi-cultivated plants, but the crops most affected are those of cacao (in all the islands), coffee (in Guadeloupe and Martinique), limes (on new clearings in Dominica) and arrowroot (in the interior districts of St. Vincent).

The disease on cacao is usually caused by the species *Rosellinia pepo*, and in most cases at the present time, the fields being well established is transmitted from the dead, or dying, shade trees, especially by *Artocarpus incisa*, *Persea gratissima*, and *Inga*. Another species, as yet unidentified, is believed to attack cacao in certain localities.

The disease on limes and coffee is caused by *R. pepo* or *R. bunodes* indifferently.

The first cases in new clearings are generally associated with decaying tree stumps, especially those of certain special trees. Subsequent cases arise from the spread of the fungus from tree to tree along the roots, or by infection from surface soil rich in decaying vegetable matter, which readily becomes infected in damp and shaded situations.

An infested tree may be killed gradually by the progressive investment of the roots, or rather quickly by the destruction of the bark around the collar. The fungus penetrates both bark and wood. Conidia are produced with great readiness wherever the mycelium emerges into the

open; perithecia occur later, and especially in the case of *R. pepo*, their formation may be much delayed.

Much can be done to prevent outbreaks of the disease by measures directed towards exposing the soil, the bases of the trees and any dead material lying about to wind and sun. This should also be done at the first signs of the disease which, however, are not easily recognised, though regular inspection may save many trees.

Infested trees should be flamed and then promptly removed, all roots dug out and burnt, the soil limed, and the place exposed as much as possible. All adjacent trees should be isolated from each other by trenches.

591 - **Wheat Varieties Resistant to Rust in the Province of Rovigo, Italy.** — See No. 541 of this *Bulletin*.

592 - **Disease Resisting Varieties of Potato, in Germany.** — See No. 542 of this *Bulletin*.

593 - **Disease Resisting Sea Island Cottons, in the United States.** — See No. 536 of this *Bulletin*.

594 - **Silver Nucleinate, a Substitute for Copper Sulphate in the Control of Vine Mildew.** — VON DEGEN, A., in *Allgemeine Wein-Zeitung*, Year 34, No. 4, pp. 25-28. Vienna, January 25, 1917.

The writer, who is the director of the Ampelological Institute at Budapest, has carried out a series of experiments in order to find substitutes for copper sulphate in the control of *Plasmopara viticola*. Amongst other remedies, silver salts were tried. Silver nitrate was eliminated because it decomposes easily under the influence of light and air.

Exhaustive experiments, however, were made with silver nucleinate. This is a characteristic combination where the silver is very loosely combined with nucleic acid; it splits off from the acid more easily than in true colloidal compounds, such as "collargol", "albargine", and "protargol".

At the request of the "Chinoinfabrik" of Kereszty and Wolf at Ujpest-Budapest, GUSTAVE FRIEDL, prepared in 1915 for the first time, silver nucleinate; this manufactory had placed some material at the disposal of the writer for the purpose of the tests. The material was delivered as a dried preparation consisting of small, greenish-black plates with a metallic lustre and completely soluble in water, giving a brownish, opaque solution. The product should keep perfectly, but the writer thinks that the aqueous solution can only be kept when protected from light. The preparation of the dry product adds considerably to its cost price, therefore, the writer advises the purchase of the cheaper solutions of 30-50 % strength.

The tests were carried out on two plots, one of which contained 28 "Italian Riesling" vine-plants, while the other contained 28 "white Sauvignon" vines. One plot was treated with a 0.5 % solution of nucleinate, the other with a 0.1 % solution. All the plants were treated five times: May 29, June 14, July 1 and 24, August 5.

The 0.5 % solution gave excellent results. During the summer, the plants on that plot had much greener foliage than those on the other;

their yield in grapes was excellent. The leaves developed in spring remained attached to the plant till the end of autumn, whilst on plants treated with other remedies or on control plots, the leaves had either all fallen by the end of autumn or only the last formed leaves remained.

The dark green colour of the leaves treated with nucleinate is due to small spots formed by the precipitation of metallic silver on the leaf. The tissue under these spots was partly destroyed. The writer intends to enquire into the subject of these spots more closely; but, according to chemists, it is certain that they are not caused by an acid.

The remedy adheres well to the leaves and the spots do not interfere with the functions of the leaf; the unspotted part of the leaf, which formed the larger part, seemed amply sufficient to keep the leaf alive as well as to supply the grapes with the necessary food substances.

The discoloration and fall of the leaves in autumn took place much later in nucleinate treated plants than in others; a large proportion of the leaves were still attached to the plant on November 7, which, from the physiological point of view, was rather a disadvantage.

The 0.1 % solution was too weak to protect the vines sufficiently against infection. Here again, there were black spots on the leaves, but mildew might have been the cause. The leaves remained attached to the plant till the middle of November.

This work refers to an attack by *Plasmopara* of medium strength, an attack where the untreated plants had lost all their leaves and where all the grapes were already destroyed by June. The foliage of vines treated with other remedies was, in part, equally destroyed.

How the remedy would act with a more intense attack cannot be safely said, but it is quite certain that the nucleinate is a poison to *Plasmopara*.

The practical use of the remedy is difficult on account of the high price — 45 crowns per kilogram of the dry product. As copper sulphate is now dearer in Austria-Hungary, it may be admitted that, in certain cases, the use of silver nucleinate would be more economical.

593 - The Influence on Germination of the Hot Water Treatment of Cereal Seeds for Smut. — See No. 533 of this Bulletin.

596 - Patents Relating to the Control of Plant Diseases and Pests. — See No. 581 of this Bulletin.

597 - On the Appearance of *Puccinia glumarum* (Yellow Rust) on Wheat in 1914 and 1916 in Germany. — MÜLLER, H. and MÖLZ, E. (Communication from the Phytopathological Station at Halle a. S.), in *Führer's landwirtschaftliche Zeitsung*, Year 66, Part 2, pp. 42-45. Stuttgart, January 15, 1917.

On account of the several attacks of the yellow rust of cereals on wheat in April and May, 1916, the writers sent a series of questions to the farmers in the phytopathological district of Halle, in order to determine the amount of damage caused by the rust. A similar series had already been distributed in 1914. The comparison of the two series of replies allows the writers to draw the following conclusions.

1) The appearance of the yellow rust is favoured by difficult growth

of the wheat plant; in 1914 and 1916, growth had suffered from drought and very cold nights; this abnormal conditions had also favoured the germination of the uredospores.

2) The various varieties of winter wheat behave differently with regard to the rust; early varieties are more liable to the disease than late ones; Rivetts Bearded wheat was very resistant, and the variety "Crievenner 104" was fairly resistant to rust; Squarehead wheats were very liable to it.

3) As regards the influence of manuring on the advent of the fungus, the question is not yet decided, especially for the nitrogen; it is certain that potash and phosphoric acid increase the resistance.

4) On heavy, deep and damp soils, less damage was caused than on shallow dry soils. Rust was never found on marshy soils, rich in mineral matter; whilst on soils poor in food stuffs (especially in the upper trias and the shelly limestones) it appears in mass; however, the writers are not in a position to generalise on these observations.

5) The best crop to precede wheat in the rotation was found to be sugar-beet: by mellowing the soil and improving the water content, it renders difficult the appearance of rust; cereals (specially oats) and sometimes lucerne, which require a large water supply and thus leave the soil already dry for the wheat, are less suitable for preceding wheat in the rotation.

6) Late sown wheat (end of October, beginning of November) were little subject to rust, but this cannot be generally applied.

7) The presence of meadows and watercourses near the wheat fields have had a favourable influence on the appearance of rust.

538 - *Cystospora batata* n. g. and n. sp. the Cause of "Soil Rot" or "Pox" in *Ipomoea* (*Batatas*). — ELLIOT, JOHN, A., in *Science*, New Series, Vol. XLIV, No. 1142, pp. 709-710. Lancaster Pa. November, 1916.

In 1891, HALSTEAD published the results of his study of the "soil rot" of sweet potatoes which he ascribed to the fungus *Acrocystis Batatas*.

The writer describes in the present preliminary note observations made by him in 1916 at Delaware (United States) which led to the discovery that the disease is due to a plasmodium, and that there are 2 modes of infection. One is by the plasmodium, as a whole, causing large shallow pits; the second is by means of swarm spores; these are developed within the thick walled cyst formed by the plasmodium.

The swarm spores entered the growing points of the roots causing a pit or "pox" scar on reaching the main root. A secondary infection by swarm spores causing blister-like elevations in the skin of stored sweet potatoes has also been observed. Ordinary potatoes are also subject to the disease.

The formation of a thick-walled cyst containing several hundred swarm spores distinguishes this plasmodium from the known genera of *Plasmodiophorales*, accordingly, the name *Cystospora batata* gen. nov. sp. is proposed for this new organism.

539 - Diseases of the Sweet Potato in the United States. — See No. 543 of this Bulletin.

- 600 - *Choaneophora Cucurbitarum*, a Phycomycete Parasite on *Cucurbita* spp. in North Carolina, United States of America. — WOLF, FREDERIC A., in *Journal of Agricultural Research*, Vol. VIII, No. 9, pp. 319-327, Pl. 85-87, Washington, D. C. February 20, 1917.

During the summer of 1916, various species of *Cucurbita* in the vicinity of West Raleigh, North Carolina, were attacked by a phycomycetous fungus, *Choaneophora Cucurbitarum* (Berk. and Rav.) Thaxter. This parasite was also observed in two other localities within the State — Winston-Salem and Walnut Cove. Since these points are rather widely separated, it is believed that *Choaneophora Cucurbitarum* is generally present throughout the State. Further, from different reports received, there seems to be no doubt that the disease occurred during 1916 in other southern States.

The fungus in question has done great damage, causing a blight of the flowers and a rot of the fruits. Not only did it attack *Cucurbita Pepo*, but was also found on the fading flowers of *Cucumis sativa*, *Hibiscus syriacus*, *Hibiscus coccineus*, *Hibiscus esculentus* and *Gossypium herbaceum*.

The occurrence of *C. cucurbitarum* on *Cucurbita* spp., *Hibiscus* spp. and other plants had been previously reported. It however, appears to be parasitic only upon *Cucurbita*. The fruits are usually infected by the passage of the fungus from the fading corolla to the young fruit. The spores of the parasite, which is the only known American species of the genus *Choaneophora* are disseminated by the wind and by various insects. The conidial stage alone appears on affected parts of the several host plants. The sporangia, chlamydospore and zygosporangia stages have been produced in artificial culture. None of these stages have previously been reported by investigators within the United States. All of the reproductive stages have been noted in the same culture on agar. Conidia, sporangia and zygosporangia may mature in cultures 24 to 48 hours old.

- 601 - The Discovery of Teleutospore Sori of *Cronartium Ribicola* in the Interior of the Petioles of *Ribes Roezlii*. — COLLEY, REGINALD, II., in *Journal of Agriculture*, Vol. VIII, No. 9, pp. 329-333, Pl. 88, Washington, D. C. February 26, 1917.

A review of the scientific literature dealing with the *Uredineae*, shows that the pycnidium, oecidium, urelospore and teleutospore stages have all been found inside the tissue of the host plant. The spores produced are apparently quite normal, and fill the intercellular spaces, or force aside the softer tissue of the surrounding parenchymatous cells.

The writer here records for the first time that *Cronartium Ribicola* Fisher also forms internal, teleutospore sori. He observed the formation of teleutospores in the interior of the petioles of *Ribes Roezlii* (Regel) Caville and Britton, where they occurred chiefly in the pith and pericycle zone.

The writer thinks internal sori should be regarded as rather common teratological phenomena.

- 602 - A Disease of the Bulbs of *Narcissus* and of Other Plants in New South Wales, Australia. — DARNELL-SMITH, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 2, pp. 141-142, Sydney, February 1917.

The writer has frequently had occasion to examine diseased bulbs of *Narcissus* and other plants which usually showed healthy internal an-

external bulb scales, while the intermediate ones were brown and decayed, the decay starting near the apex and travelling downwards. Less often, the internal or external bulb scales were discoloured and diseased and, in the latter case, easily broke away at their base. As in the case of all decay, numerous bacteria were present.

Several fungi were isolated from the diseased bulbs, but investigation led to the view that they were not the primary cause of the disease.

The following explanation of the origin of the disease appears to the writer to be the most feasible. The reserve food material in a bulb is for the most part in the form of starch, which, during the growth of the bulb, whether the latter is throwing out new leaves at the commencement of the season, or forming a new bulb at the end of the season, is in a state of flux, much of it then being in the form of sugar.

When a bulb is lifted from the ground too early, before the foliage leaves have completely died off, the bulb scales contain a large amount of this sugar. At this stage the bulb appears to be peculiarly liable to the attacks of fungi, and receiving a check through severance from its root system, easily falls a prey to them. Even after the foliage leaves have died down, the bulb requires several weeks to mature and to become really ready for lifting.

On some of the foliage leaves of the daffodils examined, the writer found numerous little yellowish tuberosities occupied by nematodes; occasionally a whole bulb was found infested with eel-worms, possibly of a different species. The injury caused by these worms appears to be distinct from the rotting of the bulb-scales described above.

The writer advises those who have found their bulbs to be suffering from the rotting disease, to allow them to become mature by leaving them in the ground for about 3 weeks after the foliage leaves have completely withered.

Although Mr. DARNELL-SMITH had no occasion to examine hyacinth bulbs, he observes that the disease described by SORAUER under the name of "A Ring Disease of Hyacinth Bulbs" corresponds closely in character with the disease of daffodil bulbs studied by him. He gives a translation of Sorauer's article, from which it appears, among other things, that all the diseased portions of the bulbs were covered with *Penicillium*, which in this case behaved as a true parasite.

603 - *Helicosporium Nymphaearum* n. sp., a Hyphomycete Parasitic on *Nymphaea* in the United States. — RAND, FREDRICK, V., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 219-232, Plates 65-70. Washington, D. C., 1917.

About the middle of May, 1913, the attention of the Washington Laboratory of Plant Pathology was drawn to an irregular spotting and decaying of leaves of pond lilies (*Nymphaea* spp.) in the water gardens of Kenilworth, D. C.

On account of the severity of the disease in this particular locality and season, the present study was undertaken primarily to test the efficacy of spraying the floating leaves of a water plant with ordinary fungicides. The fungus causing the disease proved so interesting, however, that consider-

able time has also been devoted to the study of its characters and relation to the host.

A fungus belonging to the genus *Helicosporium* has been isolated from the olive-black, water-soaked spots on leaves of *Nymphaea* collected at Kenilworth D. C. and also at Arlington N. J., New York and Brooklyn N. Y.

The parasitism of this fungus has been demonstrated by successful inoculations made during 3 consecutive years on 9 species of *Nymphaea* (*N. odorata*, *C. caerulea*, *N. tuberosa*, *N. Daubeniana*, *N. zanzibariensis*, *N. Omarana*, *N. rubia*, *N. dentata*, *N. capensis*).

Hitherto, so far as has been ascertained, no data upon this disease have been published and the causal fungus is described as a new species under the name of *Helicosporium Nymphaearum*.

The fungus gains entrance to the host most readily through the stomata, which occur only on the upper leaf surface. Sections of infected leaves show the mycelium ramifying through the intercellular spaces and occasionally between cells which have become separated.

Many of the cells of the epidermis and parenchyma become filled with coagulation products, and the nuclei and chlorophyll bodies disintegrate.

In the older spots, the tissues are seen to have more or less completely collapsed and fungus hyphae are seen ramifying both between and within the decaying cells together with bacteria and various protozoa, a condition to be expected in a decaying mass of cells floating on a watery medium. The sclerotia and multiseptate conidia are developed sparingly on the diseased leaves and rather abundantly on many of the common culture media.

During the spring and summer of 1913, spraying experiments with ordinary Bordeaux mixture and with soda-Bordeaux mixture were carried out at Kenilworth. The disease had gained a considerable start before the work was undertaken; hence, its control was not as complete as it might otherwise have been. However, as shown by a careful comparison of sprayed and unsprayed plots, the leaves sprayed with Bordeaux mixture were clearly 50 per cent less injured by the disease than were the unsprayed leaves. The control by the soda-Bordeaux mixture was almost as high, but in this case, a slight spray injury to the leaves was observed. During the 2 following seasons, this treatment was continued by the owner on a commercial scale with satisfactory results.

604 - *Xylaria* sp., the Cause of Root-Rot of the Apple in Virginia, United States of America. — FROOME, F. D., and THOMAS, H. B., in *Science*, New Series, Vol. XLV, No. 1152, p. 93. Lancaster, Pa., January 1917.

An unusually destructive rot of the roots of apple trees is prevalent in the chief orchard sections of Virginia.

The symptoms of this disease have been known for some time, but the causal organism has not been determined.

Isolations made by the writers from diseased roots from a number of orchards in the State have yielded cultures of an imperfect fungus which appears to be the conidial form of a species of *Xylaria*. Inoculations made from pure cultures of these isolations into bark wounds of living apple trees in both damp chambers and in the field, have produced typical rotting of

the bark and wood, and the introduced fungus has been obtained in pure culture from the margin of these infected portions.

Recently, perithecial stromata of *Xylaria polymorpha* (Pers.) Grev. have been found on roots of apple trees in various stages of typical root-rot attack and on the stumps of several deciduous trees in a small patch of woodland immediately adjoining the orchard in question. Cultures obtained from germinated ascospores of this fungus are being used for additional inoculations into apple roots.

Pending the result of these inoculations, it seems reasonably certain that more than one species of *Xylaria* are involved, since certain cultural distinctions exist between some of the isolations; these, however, may, be varietal rather than specific.

Apparently all varieties of the apple tree are susceptible and probably equally so.

WEEDS AND PARASITIC FLOWERING PLANTS.

605 - *Plantago Psyllium*, a New Weed in South Australia. — OSBORN, T. G. B., in *The Journal of the Department of Agriculture of South Australia*, Vol. XX, No. 5, pp. 260-362, 1 fig. Adelaide, December 1910.

Plantago psyllium L. (flea-seed) is one of the most recent additions to the alien weed flora of South Australia. The plant was sent for identification to the Agricultural Bureau of Nantawarra at the end of October 1916 together with the information that it was spreading rapidly in the district. Since it is likely that the weed will continue to spread, particularly in sandy districts — unless precautionary measures are taken — the writer gives a short description of the plant, so that farmers may be on the watch for its first appearance and check it before it becomes a serious nuisance.

The record of this *Plantago* by the Nantawarra Agricultural Bureau is the first notice of its occurrence in Australia.

It was probably introduced into South Australia in ballast, and may have spread up from the coast.

In some parts of Europe and in the Orient, a gummy substance is extracted from the seeds which is used for imparting a "finish" to textiles; it is also employed medicinally. Since however, on enquiry, it appeared very unlikely that any use could be made of the seeds in Australia, the writer recommends that this plant be destroyed wherever found. As it is an annual, this should be fairly easy, if the matter is taken in hand in time.

606 - *Euphorbia Peplus* and *Aster subulatus*, Weeds of New South Wales. — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 2, pp. 131-133, 2 Coloured Plates, Sydney, February 1917.

A description of *Euphorbia Peplus* Linn. (petty spurge) and of *Aster subulatus* Mich (bushy starwort). The first of these 2 plants is common in

the coastal districts of most of the Australian States; like other Euphorbias, it has medicinal properties.

Aster subulatus occurs frequently in New South Wales, especially in damp situations.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

607 - List of the *Coccidae* of Porto Rico (1). — JONES, T. H., in *The Journal of the Board of Commissioners of Agriculture, Porto Rico*, Vol. 1, pp. 1-16. San Juan, P. R., 1917
The list includes.

1) *Icerya montserratensis* Riley and Howard, collected: on orange at Mayagüez and at Bayamón; on twigs and undersides of leaves of an undetermined tree at Santurce (near San Juan); on the undersides of leaves of "caimito," (*Chrysophyllum argenteum*) at Río Piedras; on "maricao" (*Byrsonima spicata*), *Casearia sylvestris*, coconut palm, "guaina" (*Inga laurina*), "guava" (*I. vera*), "saman" (*Pithecolobium Saman*), and "guayaba" (*Psidium guajava*) at Mayagüez.

2) *Orthezia insignis* Dougl., on an undetermined plant at Dorado; on *Eupatorium odoratum* at Comerio; on *Ipomoea tilacea*, at Río Piedras; on *Coleus* sp., *Hamelia patens*, *Ipomoea fastigiata*, *Lactuca* sp. and *Lantana Camara*, at Mayagüez.

3). *Conchaspis angraei* Ckll., on the branches of *Codiaeum* sp., at Mameyes;

4) *Asterolecanium aurum* Bdv., on the leaves of an undetermined plant, at San Juan;

5) *A. bambusae* Bdv. on bamboo at Bayamón, Utuado and Río Piedras;

6) *A. lanceolatum* Green, on bamboo at Río Piedras;

7) *A. pustulans* (Ckll.), on "guanábano" (*Anona muricata*) at San Juan and on a Leguminosae at Guayama; on *Ficus Carica*, *Grevillea robusta*, *Castilleja* spp. and *Inga vera* at Mayagüez; on "escoba" (*Sida antillensis*) and "jazmín" (*Jasminum Sambac*) at Río Piedras;

8) *Phenacoccus gossypii* Towns. and Ckll. on cotton at Humacao;

9) *Pseudococcus calceolariae* (Mask.), on sugar-cane at Río Piedras; the fungus *Aspergillus flavus* occurs on this species.

10) *Ps. citri* (Risso) an enemy of citrus, pineapple and coffee in the island; specimens of a coccid very closely related to this species were collected on the roots of celery (*Apium graveolens*), corn (*Zea mays*) and a grass (probably *Sporobolus jacquemontii*) at Río Piedras.

11) *Ps. nipae* (Mask.) on coconut palm (*Cocos nucifera*) at Santurce; on guava or "guayaba" (*Psidium Guajava*), on *Anthurium acaule* sour-sop or "guanábano" (*Anono muricata*), *Chrysophyllum argenteum* and on *Musa paradisiaca* at Río Piedras; on sea-grape or "uvero";

(1) See also *B.*, June 1911, No. 2002; *B.*, Jan. 1916, No. 129.

(Ed.)

(*Coccoloba uvifera*) and "aguacate" (*Persea gratissima*) at Naguabo; the fungi *Cephalosporium lecanii* and *Empusa Fresenii* live on this coccid.

12) *Ps. sacchari* (Ckll.), on sugar-cane at Bayamón, Mayagüez and Humacao; the larvae of *Karschomyia coci* were found in colonies of *Ps. sacchari* (?) on sugar-cane.

13) *Chaetococcus bambusae* (Mask.), on bamboo at Mayagüez.

14) *Pulvinaria psidii* Mask., a species which is often very abundant on the "jobo" tree (*Spondias lutea*), and also reported on orange and coffee; it was found on mango (*Mangifera indica*), at Río Piedras, on (*Psidium guajava* at Río Piedras and Luquillo, on *Spondias lutea* at Arroyo and Río Piedras, on a tree, *Rauwolfia tetraphylla* at Ponce.

15) *Ceroplastes ceriferus* (Anderson), on "almacigo" (*Elaphrium Simaruba*) at Santa Rita, near Guánica, and on "yerba de San Martín" (*Sauvagesia erecta*) at Naguabo.

16) *C. cirripediformis* Comst., on an undetermined plant at Al-parrobo.

17) *C. floridensis* Comst., on *Anona reiculata*, on citrus, rose and orange in the island; on *Rapanea guianensis* and *Ficus laevigata* at Río Piedras, and on *Psidium guajava* and *Mangifera indica* at Mayagüez.

18) *Vinsonia stellifera* (Westw.), often found in large numbers on the leaves of "pomarrosa" or rose apple (*Eugenia jambos*), *Mangifera indica* and coconut, it was found on this last plant at Cataño (?), Arroyo and Santurce, on *E. jambos* at Río Piedras and Mameyes, on *Mangifera indica* at Santa Isabel, on "maguey" (*Agave sisalana*), *Musa* sp. and *Psidium Guajava* at Mayagüez;

19) *Inglisia vitrea* Ckll., on pigeon pea or "gandul" (*Cajanus indicus*) at Mameyes and Comerio; on "achiote" or "annato" (*Bixa orellana*) at Río Piedras.

20) *Coccus hesperidum* (Linn.) on *Agave sisalana* at Río Piedras.

21) *C. mangiferae* (Green) on *Eugenia jambos* at Río Piedras; on *Mangifera indica* and *Cinnamomum zeylanicum* at Mayagüez; the fungus *Cephalosporium lecanii* is often found on this scale;

22) *Saissetia hemisphaerica* (Targ.), previously noted: on the egg-plant, (at Cataño), on coffee, *Anona muricata*, cassava (*Manihot utilissima*), orange and *Citrus* in general in the island; recently noted: on "jasmin" (*Gardenia jasminoides*), the introduced pepper tree (*Schinus molle*), *Eugenia jambos*, *Graptophyllum pictum*, *Persea gratissima* at Río Piedras; on "marunguey" (*Zamia integrifolia*), at Vega Alta; on *Sida*, sp., on black nightshade or "mata-gallinas" (*Solanum nigrum* var. *americanum*), and *Psidium Guajava* at Luquillo; on "café" (*Coffea arabica*), and *Thunbergia erecta*, at Mameyes; on "orozuz" or "pascueta" (*Leptilon canadense*) at Ciales; on *Rauwolfia tetraphylla*, at Ponce; on *Antigonon leptopus*, *Drypetes glauca*, and *Solanum seaforthianum* at Mayagüez; the fungus *Cephalosporium lecanii* lives on this scale;

23) *S. nigra* (Wietn); on "almendra" (*Terminalia catappa*) and on cotton, at San Juan; on "anamá" or "cadillo pequeque" (*Pavonia Typhalea*), at Canovanas; on "algodón" (*Gossypium barbadense*) at

Guánica; on China berry or "lilaila" (*Melia azedarach*) at Fortuna (near Ponce); on *Schinus molle* at Río Piedras; on *Solanum nigrum* var. *americanum*, *Melia azedarach* and *Sida*, sp. at Luquillo; on *Euphorbia sanguinea* at Mayagüez; from material including *S. nigra* and *Hemichionaspis mino*, a parasite was reared which was identified later as *Arrhenophagus chionaspidis* Auriv;

24) *S. oleae* (Bern.) on Calabassa tree (*Crescentia Cujete*) at Lares, on honey locust (*Gleditsia triacanthos*), at Adjuntas; on *Guazuma ulmifolia* at Guayama; on *Terminalia Catappa*, Mayagüez and Guánica; on "madro de cacao" (*Erythrina glauca*) at Río Piedras, on orange oleander (*Nerium oleander*) and "berengena cimarrona" (*Solanum torvum*) at Mayagüez.

25) *Aclerda tokionsis* (Ckll.), on sugar cane at Río Piedras.

26) *Chionaspis citri* Comst., one of the most injurious scale-insect of the citrus; it appears to be generally distributed all over the island its natural enemy is *Aspidiotiphagus citrinus* (Craw.)

27) *Howardia biclavis* (Comst.), on *Bixa orellana* at San Sebastián; Añasco and Río Piedras, on "caimito" (*Chrysophyllum cainito*) and "mamey" (*Mammea americana*) at Mameyes; on "algarrobo" (*Hymenaea Courbaril*), on *Casearia arborea*, on silver oak (*Grevillea robusta*), and *Cajanus indicus* at Río Piedras; on "palo de cucubano" (*Gueitarda scabra*) and *Cordia* sp. at Dorado; on "roble" (*Tecoma pentaphylla*) and *Acalypha Wilkesiana* at Naguabo; on "nispero" (*Achras sapota*), *Coffea arabica*, *Doryalis cajra* and *Plumiera rubra* at Mayagüez.

28) *Diaspis echinocacti* (Bouché), recorded at Porto Rico by FERNALD.

29) *Aulacaspis pentagona* (Targ.), lives on many plant hosts in the island; already recorded on "higuerete" (*Ricinus communis*) at Río Piedras, on an undetermined tree at Bayamón, on peach at Adjuntas, on *Gleditsia triacanthos*; on "majagua" (*Paritium tiliaceum*) at Fajardo; frequent in the island on orange, mulberry, "papaya" (*Carica papaya*), plum; observed on *Hibiscus esculentus* and pepper; taken also from willow (*Salix* sp.) at Ponce; on "bruja" (*Bryophyllum pinnatum*); at Comerío; on *C. papaya* and *Cajanus indicus* at Río Piedras; on *Paritium tiliaceum* at Mameyes and Adjuntas; on "cadillo" (*Urena lobata*) at Dorado; on *Ricinus communis* at Ciales; on *Mammea americana* at Naguabo; on *Hibiscus esculentus*, *Hyptis* sp., *Solanum torvum*, *Trema micranth.* and *Acalypha Wilkesiana* at Río Piedra s; on *Mangifera indica*, *Erythrina* sp. and *Nerium oleander* at Mayagüez; on *Manihot utilisima* at Añasco.

30) *Hemichionaspis aspidistrae* (Sign.) on *Nephrolepis exaltata* var. *bostoniensis*, at Río Piedras;

31) *H. minor* (Mask), on eggplant at Cataño; on *Guazuma ulmifolia* at Guayama; on *Gossypium barbadense* at Guánica; on *Melia azedarach* at Fortuna; on "yerba rosario" (*Aeschynomene sensitiva*) and ornamental croton (*Codiaeum* sp.) at Naguabo; on "verbena" (*Valerianoides jamaicensis*) at Río Piedras; on *Solanum torvum* and "cadillo" (*Triumfetta semitriloba*) at Luquillo, on *Lantana involucrata* at Mameyes, on *Asparagus Sprengeri* and *Pithecolobium Saman* at Mayagüez.

32) *Pinnaspis buxi* (Bouché) on an epiphyte of the *Bromeliaceae* at Mameyes, on *Philodendron* sp. at Ciales, on "corozo" (*Acrohomia media*) and *Areca lutescens* at Río Piedras;

33) *Leucaspis indica* Mar., on *Mangifera indica* at Mayagüez;

34) *Aspidiotus cyanophylli* Sign.; on *Eucalyptus* sp. at Naguabo.

35) *A. destructor* Sign. (seems to be the first scale-insect recorded on the island), is very common, especially on the undersides of the leaves of coconut palms, which it damaged seriously at Ponce in 1934; first collected at San Juan, it was also found later on the leaves of banana in the same district and at Cataño and Arroyo; it has also been found on the coconut at Santurce, on silk oak (*Grevillea robusta*), *Psidium Guajava* and *Musa paradisiaca* at Río Piedras; on *Persca gratissima* at Mameyes and Guayama; on *Anona palustris* and *Mammea americana* at Río Piedras, and on date palm (*Phoenix dactylifera*) at Mayagüez.

36) *A. forbesi* Johnson, recorded at Porto Rico by FERNALD;

37) *A. lataniae* Sign., on *Castilleja* at Mayagüez;

38) *A. sacchari* Ckll., on sugar cane, at Guánica, Fortuna, Fajardo, Canóvanas, Río Piedras and Humacao;

39) *Pseudonidius tessellata* (de Charm.) on rose-tree at Mameyes;

40) *Selenaspis articulatus* (Morg.) on orange leaves at El Yunque; on *Eugenia jambos*, *Anona muricata* and *Ficus nitida* at Río Piedras; on *Eucalyptus* sp. at Naguabo;

41) *Chrysomphalus aonidum* (Linn.) a serious enemy of citrus in the island; collected on *Terminalia catappa* and *Anona muricata* at San Juan; on *Nerium Oleander* at Ponce; on *Musa* at Caguas; on *Ficus nitida* at Río Piedras, on sisal hemp (*Agave sisalana*) at Mayagüez;

42) *Chrys. aurantii* (Mask.) on *A. muricata* at San Juan and Ponce; also recorded as injurious to citrus in the island.

43) *Chrys. bifurmis* (Ckll.), on "maya" (*Bromelia pinguin*) at Mameyes; on *Agave sisalana*, *Persca gratissima* and *Mangifera indica* at Río Piedras, on *Cycas revoluta* at Naguabo;

44) *Chrys. dictyospermi* (Morg.), on *M. indica* at Río Piedras and on *C. revoluta* at Naguabo;

45) *Chrys. personatus* (Comst.) on banana at Caguas and Cataño, on *A. muricata* at San Juan; on coconut palm at Mayagüez, Caguas and Santurce; on *Eugenia jambos* at Río Piedras, on *M. indica* at Santa Isabel; on *Ficus* sp. and *Mammea americana* at Mameyes; on *Eucalyptus* sp. at Naguabo;

46) *Pseudischnaspis bowreyi* (Ckll.), on *Asparagus plumosus* at Mayagüez;

47) *Pseudoparlatoria ostreata* Ckll., on *Solanum scaberrimum* and *Acalypha* sp. at Mayagüez;

48) *Lepidosaphes beekii* (Newm.), recorded more often than any other scale insect as injurious to citrus in the island; also collected on *Codiaeum* at Río Piedras; the fungi *Myriangium Duriaei* and *Sphaerostilbe coccophila* live on this species;

49) *L. lasianthi* (Green), on leaves of *Croton humilis* at Río Piedras;

50) *Ischnaspis longirostris* (Sign.) on coconut palm at Caguas, Cataño, Mayagüez and Arroyo; on *Citharexylum fruticosum* at Naguabo; on *Ixora ferrea*, *Asparagus Sprengeri*, and *Acronomia media* at Río Piedras. A bibliography of 25 works is appended.

608 - *Lepidosaphes tuberculata* n. sp., *L. diaspidiformis* n. sp., and *Dinaspis annae* n. sp., Scale Insects Recorded in Italy, Chili and Barbadoes Respectively. — MALENOTTI, ETTORE, in *Redia*, Vol. XII, Parts I-II, pp. 183-194, pl. I. Florence, 1917.

Description of the 3 following scale insects:

1) *Lepidosaphes tuberculata* n. sp.: males and females found in abundance on both sides of some leaves of *Cymbidium Tracayanum*, in the greenhouse of the Royal Pomological School at Florence (Italy) on May 3, 1916; many of the female scales were bored by parasites;

2) *L. diaspidiformis* n. sp.: males and females in plenty on the upper side of two leaves of *Myrcogenia planipes*, taken in the province of Manquihue (Chili) by Prof. MARCIAL ESPINOSA BUSTOS of the National Museum of Santiago and sent to the Royal Station for Agricultural Entomology at Florence on May 29, 1916; some females were parasitised by a fungus that completely filled the body;

3) *Dinaspis annae* n. sp.: very abundant male and female scales on the branches of *Citrus Medica*, with *Lepidosaphes citricola* Pack. and *Aonidiella auranti* (Mask), taken at Barbadoes by Mr. H. A. BAILLOU and sent to the Royal Station for Agricultural Entomology at Florence on July 4, 1916.

609 - On the So-called Varieties of the Scale Insect *Chrysomphalus dictyospermi*, Injurious to Citrus Plants. — MALENOTTI, ETTORE, in *Redia*, Vol. XII, Parts I-II, pp. 109-123, fig. 1-6. Florence, 1917.

According to the writer, there are no true varieties, properly so-called, among the recorded forms of the scale insect *Chrysomphalus dictyospermi* (Morg.) Leon, and called: *Chrys. dictyospermi* var. *pinnatifera* Mask., *Chrys. dictyospermi* var. *arecae* Newst., *Chrys. dictyospermi* var. *jamaicensis* Ckll., *Chrys. dictyospermi* var. *mangiferae* Ckll.

Chrys. dictyospermi attacks plants belonging to at least 80 species of about 25 widely different families, both in tropical and temperate regions. The scale is distributed in a zone vast from the point of view of latitude and very vast from the point of view of longitude. It attacks greenhouse plants (London, Florence, United States, etc.) as well as those grown in the open (Algeria, Sicily, Liguria, Spain, etc.).

The writer is of the opinion that the scale insect is more sensitive than many others to variations in environment. This sensitiveness, together with the wide distribution and large range of host plants of this insect, affords sufficient explanation of the many local forms which, on account of the facility with which their characters change, can not be considered as groups constituting varieties.

610 - *Bacillus Lymantriae*, *B. Liparis* n. sp. and *Diplococcus Lymantriae* n. sp., Parasites of the Larvae of the "Unlike Bombyx" (*Lymantria dispar*), in France. — PAILLOT, A., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1st. Half-Year, 1917, Vol. 164, No. 13. pp. 525-527. Paris, 1917.

Three bacteria have been isolated from the larvae of the Macrolepidopteron *Lymantria dispar* L. The writer has provisionally identified one of them as that described by PICARD and BLANC under the name of *Bacillus Lymantriae*. The second is a *Diplococcus* forming a distinct species, and named by the author *D. Lymantriae*, it is not very pathogenic to the larvae and an inoculation of a pure culture is not always mortal. The third, provisionally named *B. Liparis*, is more pathogenic to the larvae of *L. dispar* than *Dipl. Lymantriae*.

611 - *Sorospora Uvella* and Its Occurrence in Cutworms in America. —

SPEARE, A. T., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 189-194. fig. 1. Pl. 66, Washington, D. C., February 5, 1917.

In 1888, SOROKIN described and illustrated as a parasite of the cutworm (*Agrotis segetum* Schiff.), in Russia, a fungus which he called *Sorospora agrotidis* n. gen. and n. sp. As regards the systematic position of the parasite, which was not defined by SOROKIN, subsequent writers have suggested its affinity to the Entomophthorales on account of its apparent resemblance to the genus *Massospora* Peck, which FORBES and THAXTER have shown to be entomophthoraceous.

In 1889, GIARD translated SOROKIN's article into French, and in the issue of the publication, followed it by a note in which he pointed out that *Sorospora agrotidis* was undoubtedly identical with *Tarichium uvella* Krassiltschik (1886).

Since, as is shown by the writer, the fungus in question is in no way connected with the Entomophthorales, the use of the generic name of *Tarichium* becomes invalid. Hence the correct name for the organism is *Sorospora uvella* (Krass.) Gd. since Giard was the first to recognise that the form described by SOROKIN was identical with that described by Krassiltschik.

The writer received in June 1916, two larvae and one pupa of *Euxoa tessellata* Harris which had died in breeding jars. The insects originally came from College Park, Md. No fungus was visible externally, but upon breaking open the larva a reddish-brown powdery spore mass was seen which completely filled the interior of the insect's body. Microscopic investigation demonstrated that the fungus was *S. uvella*. Several more infected insects were received in July.

So far as the writer is aware, there is no record of *S. uvella* in Europe since 1888, and further, this seems to be the first published account of its occurrence in America, except for a brief note of its presence in Ottawa, Canada in 1915 by GIBSON. The writer hopes soon to test the parasitism of *S. uvella* and to give an account of these experiments, as well as to make a more complete study of the life history of the organism.

- 612 - *Scutellista gigantea* n. sp., a Chalcid Parasite of the Coccid *Ceroplastes mimosae*, in Eritrea. — BERLESE, ANTONIO in *Redia*, Vol. 12, Pt. I-II, pp. 179-180. Florence, 1917.

A systematic description of the new hymenopteron *Scutellista gigantea* taken from *Ceroplastes mimosae* Sign. (= *C. africanus* Green), and found in Eritrea by Dr. GUICCIARDINI.

- 613 - *Chaetocnema ectypa* ("the desert corn flea-beetle") a Coleopteron Parasitic on Cultivated Gramineae and Lucerne, in the United States of America. — WILDERMUTH, V. L., in *United States Department of Agriculture, Bulletin* 436, pp. 1-23, Fig. 1-7, 1 Pl. Washington, D. C., February, 1917.

Chaetocnema ectypa Horn, is present in injurious numbers in the cultivated areas of the southwestern United States, where it attacks maize, sorghum, sugar cane, wheat, barley and lucerne. From the fact that it is a native of southwestern desert regions, the little black insect has been named the "desert corn flea-beetle". Both the adults and larvae injure crops, the former feeding upon the top of the plants, and the latter upon the roots.

The eggs are deposited at, or near, the surface of the ground, and hatch in about 6 days. The young larvae are found within the tender roots of the food plants, while the older larvae live in the soil near these roots. The average length of the larval stage is 32 days.

The prepupal and pupal stages are both passed within a cell in the soil near the roots on which the larvae feed.

The flea-beetles in the adult stage hibernate under rubbish, or at the base of various grasses growing in the regions of infestation (*Hordeum murinum*, *Distichlis spicata*, *Sorghum halepense*, *Sporobolus airoides*, etc.).

The total length of the life cycle of this beetle is about 7 weeks, there being from 3 to 4 generations in the year.

The number of adults can be greatly reduced by the destruction of their hibernation quarters and the eradication of some of their weed food plants (*S. halepense*, *D. spicata* etc.). They can be further diminished by carefully cultivating those crops which can be grown after irrigation as soon as the soil becomes dry. This method destroys a great many pupae. Small plots of maize can be sprayed successfully with arsenate of lead, using 2 pounds to 50 gallons of water, the water being made into a strong soap solution. This acts both as a repellent and as a poison to the beetles.

Injury to maize and other crops can be partially overcome if the soil is placed in the best possible cultural condition by the addition of farmyard manure, or other fertilisers.

At Tempe (Arizona) the adult flea-beetles have been observed to be preyed upon by the nymphs and adults of *Reduvius fers* L., while in the same district the writer discovered that a small parasitic wasp, *Neurepyris* sp. attacked the larvae and prepupae of *Chaetocnema ectypa*. At Holtville (California), the writer found a great many of these beetles with their bodies almost covered with a species of mite (*Pediculoides* sp.).

614 - Investigations on *Helopeltis*, a Capsid Parasite of Tea. — LEHMANS, S., in *Mededeelingen van het Proefstation voor Thee*, No. 50, Batavia 1916.

The following species of *Helopeltis* occur in Java: *H. antonii* Sign., *H. theivora* Waterh., *H. cuneatus* Dist., and *H. cinchonae* Mann.

H. antonii is the chief enemy of tea in Java. At over 4300 feet in altitude occurs a local variety of *H. antonii* which was formerly described as *H. bradyi*. It is now provisionally named *H. antonii* var. *bradyi*. The variety differs from the type in some morphological characters, as well as in the fact that it usually attacks *Cinchona*. Tea is rarely attacked and then never severely.

H. theivora, which is the most dangerous enemy of tea in British India does not do much harm in Java: in West Java it only occurs in the lowlands.

H. cuneatus, a new species for Java that does not attack tea and is only found on plants of the family Araceae.

H. cinchonae, also new for Java, has recently been found to attack tea and may become serious in the future.

The writer gives a detailed account of the biology of these species and finds that *H. theivora* is in many ways similar to *H. antonii*. The important difference in the duration of the various stages of *H. antonii* at different altitudes is fully discussed. At 800 ft. the life cycle requires 19 to 22 days, and at 3600 ft. 23 to 35 days. The females lived as long as 50 days, while the highest number of eggs laid in 34 days was 235.

The cause of the damage to the tea leaf is not certain, but the spots are supposed to be caused by an excretion. As the results of several experiments to determine the average damage caused by larvae and adults it was calculated that the progeny of one female, can spoil about 2.8 milliard kilos of leaves in 6 months.

The natural enemies of *Helopeltis* are discussed. Some species of Mantids eat the larvae and adults, but they are of little practical importance. The Reduviid *Sycanus collaris* F. is also not important as a control. Spiders were imported from Europe, but though they were successfully imported, their value is not yet clear. An ant *Dolichoderus bituberculatus* Mayr. attacks *Helopeltis* on *Theobroma Cacao*, the cacao-tree, but its use on tea plantations is not possible for practical reasons. Experiments with other Rhyncota that parasitise the eggs of *Helopeltis* were unsuccessful.

Bacterium found in a dead *Helopeltis* was grown in culture, but gave no convincing practical results. An insectivorous fungus *Metarrhizium* gave better results, but its practical application is, as yet, uncertain.

Belts of trees planted to keep the insects from the plantations are useless and may become dangerous, as they act as traps for insects carried by the wind and thus are collected at the plantations. In one case, cutting down a belt of trees gave a good result, allowing free entry to the wind.

As regards the influence of climatic conditions, an enquiry made on 57 estates showed that drought is usually fatal to the insects.

The original food plants of *H. antonii* in the jungle and forest could not be found, though there is evidence to show that *Helopeltis* passes the

dry season in the jungle, few insects being then found on the tea. The dry season is, therefore, a suitable time for a strict control over the few surviving insects.

In experiments as to immune varieties while it was found that all the Javanese varieties were attacked, the Java-China tea suffers the most of all.

The planters in Java formerly thought *Cinchona* and *Tea* were each attacked by a separate species. On the contrary, the writer found that up to 4300 ft. *H. antonii* Sign. (type) attacked both plants, while over 4300 ft in altitude the var. *bradyi* is found, which usually prefers *Cinchona*. The presence of *Cinchona* under 4300 feet may be considered as dangerous if near tea.

An elaborate investigation has been made of the food plants of *H. antonii* and *H. theivora*, especially of the weeds occurring in the tea gardens, and of the leguminous plants used for green manuring. The following species of leguminous plants are badly attacked by *Helopeltis* under laboratory conditions: *Albizia moluccana* Miq., *Erythrina indica* Lam., *Tephrosia Vogeli* Hook. f., *Teph. Hookeriana* Wight et Arn. The insects can live on these plants for several weeks. Weeds, which were attacked under laboratory conditions, and on which *Helopeltis* lived for a considerable time, are: *Richardsonia brasiliensis* Hayne, *Melastoma malabathricum* L., *Erigeron limifolius* Willd., *Bidens pilosa* L., *Dichrocephala latifolia* DC., *Erechtites valerianaeifolia* DC. Also in the tea gardens damage by *Helopeltis* was observed on these plants principally when the tea was pruned low.

The Awi tali Bamboo (*Bambusa Apus* Schult. f.) may be considered as suspect, as the insects remained alive on this plant for 10 days. On Casso (*Saccharum spontaneum* Linn.) and Alang alang (*Imperata arundinacea* Cyr.) the insects died within two or three days; these grasses are thus probably not food plants. Some plants were found spotted on the secondary wood, as if attacked by *Helopeltis*; the damage was not due to *Helopeltis* but to another Capsid bug: *Pachypeltis vittiscutis* Berg. The affected plants are: *Villebrunea rubescens* Blume *Leca aequata* Linn., *Arthrophyllum diversifolium* Blume and *Saurauja* sp.

Both *H. antonii* and *H. theivora* feed on a large variety of plants.

The connection between the pest and the cultural methods for tea in Java is discussed. No definite opinion could be formed as to whether forced plucking had any favourable effect, as the results varied greatly.

The idea of some planters, that the tea would become immune after several attacks, has no sound foundation. The cause of the spontaneous disappearance of the pest in some cases, can, as far as the author can see, only be due to lack of food, removal of the pest by the wind or special climatic conditions.

Pruning is often tried to get rid of the pest, but it is often forgotten that this measure causes a migration of the insects which may become very fatal when newly pruned gardens are adjacent, or where the tea is in a weak condition consequent upon pruning. In this case pruning must be delayed until the danger has decreased. If low pruning must be done, it

must be taken into account that pruning of small plots is to be avoided. Pruning of large areas (say 40 bahoes in one month) will delay re-infection for a longer time. As the insects are carried in the direction of the prevailing winds, it is advisable to prune the gardens with the wind and never against it.

Weedy gardens are as a rule not more attacked than clean gardens. Methods such as: 1) fumigating with the smoke from burning rubbish with or without sulphur, 2) fumigating the shrubs individually with sulphur cartridges, 3) scorching the shrubs by means of soldering lamps, are of no avail.

The following measures are discussed as regards their utility for combating the pest:

1) Twigs containing eggs should be collected before they hatch out.
2) Catching *Helopeltis* by hand is often very effective, if started as soon as the pest appears. Most of the tea planters in Java carry out hand-catching. The early morning is a good time for catching the larvae but the work, should be continued through the whole day, if possible.

3) Experiments were made with different insecticides, but the spray, even if strong enough to kill the plant, does not kill all the eggs. Larvae and adults can be destroyed by spraying with a 2 % soap solution. Spraying was found to be cheaper than handcatching. Spraying should be carried out immediately after pruning, and may be continued for 7 months, after which handcatching must be applied, as the shrubs are then very dense. Spraying and handcatching combined gave good results. In fixing the periods between two successive gangs of spraying or handcatching, the length of the larval stage must be considered.

4) Pruning of small areas is not advisable. The best is to prune a large area rapidly, says about 40 bahoes per month. Pruning should take place with the wind, never against it; in the rainy seasons the prunings must be destroyed the same day, while in the dry season it suffices to spread them out in thin layers. Adjacent estates should make an agreement as to the time of pruning so as to prevent one estate being infected by another. Thus a badly attacked garden should not be pruned if a newly pruned garden is adjacent.

5) Weeding must be done at the same time as or immediately after pruning.

6) If tea is grown near *Cinchona* at an altitude of less than 4300 feet, pruning of *Cinchona* and other cultural methods which cause migration of the pest from the *Cinchona* to the tea, must be done before the adjacent tea gardens are pruned.

7) Leguminous plants, which are also host plants of the insect must be avoided; if they have been planted they must be pruned at the same time as the tea.

Hedge plants such as *Bixa Orellana* Linn. and *Gardenia grandiflora* Lour must not be allowed to grow near tea gardens. If *Helopeltis* accumulates at the edge of the forest, or in tree belts, the complex of plants harbouring it should be destroyed.

8) Remedial measures must be applied at the first appearance of the pest which must never be allowed to become serious. Premiums should be given to ensure careful control and searching. Handcatching or spraying when the pest has become serious are useless, and simply a waste of money.

615 - *Pseudococcus nipae* (= *Dactylopius nipae*), a Scale Insect Injurious to Palms, in Hungary. — JABLONOWSKI, J., in *Zeitschrift für Pflanzenkrankheiten*, Year 1917, Vol. 27, Part 1, pp. 1-18. Stuttgart, February 15, 1917.

During some experiments made in a glasshouse in Hungary in February, 1916, the author found on a palm a number of male scale insects, which he at first thought to be *Pseudococcus adonidum* L., a very common insect of Hungarian glasshouses. Further examination of the insect and particularly of the females showed that it was a species new to Hungary, i. e. *Pseudococcus nipae* (Mask.) Fern. (= *Dactylopius nipae* Mask.), first described by MASKELL in an Australian publication. Later, NEWSTEAD (1893), MARCHAL (1908) and LINDINGER (1912) have described the insect.

In studying the literature, the Author found that the descriptions by the three scientists did not agree and that they were inexact on several points. As he had abundant material, the writer has carefully studied the insect. In the present work, he gives a detailed account of the morphological, physiological and biological characters of the insect and compares his results with that of the previous authors, finally dealing with the geographical distribution and economic importance of this scale insect.

Ps. nipae has probably been imported into Hungary from Belgium with palm trees. The insect is very common in glasshouses at Budapest. It is found on very different palm trees, chiefly on *Phoenix*, *Kentia*, *Lalania* and *Areca*, to which it causes considerable damage; but the writer thinks that the damage would be less than that of *Ps. adonidum*, if the palms were cleared from time to time.

This does not prevent the scale insect from becoming a serious pest, and the author advises German and Austrian gardeners and experimentalists to determine the glasshouses invaded by the pest so as to check its spread.

616 - *Tarsonemus* sp., a Mite Parasite on Cyclamens in Ontario, Canada. — Ross, W. A., in *The Agricultural Gazette of Canada*, Vol. 4, No. 3, pp. 174-175, 1 fig. Ottawa, March 1917.

During 1916, several complaints were received from florists in Hamilton, Brantford and Niagara Falls concerning a cyclamen disease which, by destroying the flowers and flower buds and curling the foliage, made the affected plants absolutely worthless. One florist on account of this trouble had been obliged to throw out nearly 900 out of 1 000 cyclamens.

On examining some of the diseased plants, it was found that the injury was produced by a minute mite reported by Mr. G. H. MOZNETTE, of the Oregon Agricultural College, to be an undescribed species of *Tarsonemus*. He further stated, that the same mite attacks various green-

house plants on the Pacific coast, where it has proved a very serious pest, and many florists have lost their whole crops through it.

The mites, in all stages, including the eggs, occur on the bloom and tender foliage. They may be found on almost any portion of the flower, (petals, stamens and ovary), but as a rule, most of them are discovered between the calyx and corolla. Attacked flowers become distorted, streaked and flaccid and die prematurely. In many cases, the flower buds do not open, but gradually wilt and die. Infested foliage becomes curled; at the point of attack, little depressions, or pockets, may be formed and the leaf epidermis may assume a dark, purplish and cracked appearance.

The adult mites are pale brown, ovate creatures about 0.2 mm. long. The immature forms are translucent. The eggs are oval and translucent bodies about 0.12 mm. \times 0.06 mm.

According to Mr. MOZNETTE, the parasite has been satisfactorily controlled in Oregon by spraying with a nicotine solution. The spray should be applied first when the young cyclamens are potted. From then until the flower buds are formed, subsequent applications should be made at intervals of 10 days.

It is highly probable that the addition of soap to the nicotine solution (3.6 to 4.8 %/100) would make it more effective.

